7-25-2014

The role of regret and its applications in IS decision making

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THE ROLE OF REGRET AND ITS APPLICATIONS IN IS DECISION MAKING

BY

EUN HEE PARK

A Dissertation Submitted in Partial Fulfillment of the Requirements

for the Degree

Of

Doctor of Philosophy

In the Robinson College of Business

Of

Georgia State University

GEORGIA STATE UNIVERSITY
J. MACK ROBINSON COLLEGE OF BUSINESS
2014

ACCEPTANCE

This dissertation was prepared under the direction of the Eun Hee Park Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctoral of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

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ABSTRACT

THE ROLE OF REGRET AND ITS APPLICATIONS IN IS DECISION MAKING

BY

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August 5, 2014

Committee Chair: Dr. Balasubramaniam Ramesh

Major Academic Unit: Computer information systems

Although IS studies have begun to recognize the role of emotion in decision making, the research in this area is still in its infancy. The exploration of IS decision making phenomena through the lens of regret can offer rich implications to both research and practice. The presence of regret, for instance, can explain how and why IS decision makers choose a certain option. Motivated by the gap in the literature, the three papers in this dissertation investigate the role of regret in decision making in IS contexts. Specifically, the three projects investigate the following: IT real options decision in the context of RFID investment in libraries, whistle-blowing decision in the context of violations of heath information privacy, and process documentation decision in the context of investment in process improvement initiatives in an IT project. The contributions and implications of the three studies are presented further.

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Chapter 1

Introduction

1.1 Overview

We often anticipate the feeling of regret that may result when our decisions do not yield anticipated outcomes and wonder why we did not choose one of the other available options. Regret is experienced as a sinking feeling or a self-blaming feeling and with thoughts about the mistakes made. It is often accompanied by emotivational[1] goals to undo the decision (Zeelenberg et al. 1998a). Bell (1982), originally, and Loomes and Sugden (1982a) established that decision makers anticipate regret and take that feeling into account while making decisions under uncertainty. Bell (1982) argues that the role of emotion, specifically regret, can help explain the anomalies that expected utility theory fails to explain. Zeelenberg et al. (1996) elaborate that expected utility theory takes into account only the possible pain and pleasure associated with the outcomes of a particular option under consideration. In addition, regret theory takes into account the feelings triggered by the outcomes of the rejected options.

Zeelenberg et al. (1996) argue that regret theory can be used to explain decisions that are not readily explained by utility theory because regret represents the emotional component of utility. They also articulate an important assumption behind regret theory. People compare the foregone outcomes with the foregone alternative outcomes. When they realize that the forgone alternative outcome is better than the foregone outcome, they experience regret (Reb 2008). Further,

[1] Emotivations (or emotional motives) indicates "the distinct motives or goals that accompany discrete emotions" (Zeelenberg et al. 1998, p.223). The term is originally proposed by Roseman (1984). Action tendency indicates "specific behavioral responses," while emotivations indicate "desired goal states" (Zeelenberg et al. 1998, p.223).

according to Boles and Messick (1995), social comparison with others can facilitate the comparison of outcomes. For example, if a case tool is adopted by a software engineer, its outcome can be evaluated in comparison with the outcome experienced by another user who chose an alternative tool. This comparison facilitates the evaluation of performance, features, and functions of technology.

A second critical assumption in regret theory is that regret can be anticipated. According to Janis and Mann (1977a), "regret is anticipated when the negative consequences that might ensue from the decision could start to materialize almost immediately after the decision is made" (p. 223). This emotional component of utility may be taken into account while decisions are made under uncertainty. Janis and Mann argue that the regret aversion facilitates more vigilant decision making. Since most people are regret averse, they choose options that minimize anticipated regret (Reb 2008). Recent research in IS recognizes the role of regret in IT decision making in a variety contexts such as measuring the success of decision support systems (Hung et al. 2007) and IT investment decision making (Lankton and Luft 2008).

In much of the IS literature, IT decision making has been explained using cognition-based models that focus on aspects of perception, judgment, and reasoning (such as perceived ease of use and perceived usefulness). Beaudry and Pinsonneault (2010) suggest that cognition-based models of decision making are not enough to explain decisions and behaviors. For instance, emotional drivers (such as affect, emotivation) lead one's perception to a decision or a behavior. Therefore, they argue for the need for taking into account the role of emotion to explain decisions and behaviors.

Although studies have begun to recognize the role of emotion in decision making (Hung et al. 2007; Lankton and Luft 2008), research in this area is still in its infancy. The exploration of IS

decision making phenomena through the lens of regret can offer rich implications to both research and practice. The presence of regret, for instance, can explain how and why IS decision makers choose a certain option. Motivated by the gap in the literature, the three papers in this dissertation investigate the role of regret in decision making in IS contexts. Specifically, the three projects investigate the following: IT real options decision in the context of RFID investment in libraries, whistle-blowing decision in the context of violations of heath information privacy, and process documentation decision in the context of investment in process improvement initiatives in an IT project. Table 1 below presents an overview of the research approach used in the three studies.

Table 1. Overview of the Research Approach

	Exploration Phase: Study One	Application Phase: Study Two	Application Phase: Study Three
Research Approach	Qualitative Research	Quantitative Research	Quantitative Research
Research Context	IT real options decision	Whistle-blowing decision	Process documentation decision
Methodology	Multi-site Case Study	Scenario-based Experiment	Scenario-based Experiment
Research Focus	• The role of regret in IT real options decision making • Regret regulation strategies that mitigate uncertainties in IT real options decision making	• The role of attribution (intentionality and stability) and seriousness of wrongdoing in whistle-blowing decision making • The role of anticipated regret in whistle-blowing decision making	• The role of anticipated regret in the decision to invest in process documentation • The role of requirements uncertainty and accountability in process documentation decision making • The role of the type of project (traditional vs. agile) in process documentation decision

1.2 Research Objectives

The objectives of the three research projects are the following:

- Study One: Explore the role of regret and regret regulation strategies in IT real options decision making.
- Study Two: Refine our understanding of psychological mechanisms underlying the prediction of whistle-blowing decision. Specifically, evaluate the influence of antecedents and consequences of anticipated regret in whistle-blowing decision making in the context of violations of health information privacy.
- Study Three: Evaluate the role of antecedents (such as requirements uncertainty, accountability, and the type of project (traditional vs. agile)) and the consequences of anticipated regret in process documentation decisions.

1.3 Study Design

1.3.1 Study One

While emotion significantly affects IT investment decision making, its role has been largely overlooked in prior IS research. We investigate the role of a specific emotion, regret, in IT real options decision making. We conducted a multi-site case study of the IT investment decision making process in four public libraries that considered investing in RFID technology to examine how regret impacts real options thinking. We develop a framework that explains how regret is triggered by uncertainties in the environment, and how the strategies that are used to regulate regret influence the valuation, creation, or exercise of specific real options. Our study suggests that emotion plays a significant role in real options decision making and explains how decision makers value, create and exercise IT real options. This perspective allows us to explore IT real options decision making at a psychological level, complementing prior literature on real options

thinking which primarily adopts a cognition-focused perspective. Our research also highlights that while some regret regulation strategies may be functional, others are dysfunctional in their influences on IT real options decision making.

1.3.1.1 Contributions

The findings from our study suggest that regret plays an important role in IT real options decision making. The contributions to IS literature are the following: first, we developed a framework that explains the linkages among environmental uncertainties, regret of decision makers, regret regulating strategies, and real options decision. Second, our research provides an initial step in the development of the much needed emotional perspective for understanding IT real options decision making and offers opportunities for complementing prior literature on real options thinking with the decision maker's emotion. Finally, our framework helps understand how real options are created at various phases of a project as a result of strategies used to regulate experienced regret. Thus, it provides a more comprehensive understanding of how real options are created in an IT project as the project unfolds.

1.3.2 Study Two

Potential whistle-blowers who perceived intentional or stable causes of organizational wrongdoing often face a decision to blow the whistle or to remain silent (Gundlach et al. 2003). They generally experience comparison-based emotions, viz. regret associated with whistle-blowing or remaining silent (Edwards et al. 2009). Although it is commonly assumed that potential whistle-blowers take anticipated regret into account in their whistle-blowing decision, this assumption has not yet been empirically investigated.

In this study, we use attributional theory of motivation and emotion (Weiner 1980) and a model of whistle-blowing decision (Gundlach et al. 2003) and examine the role of attributions,

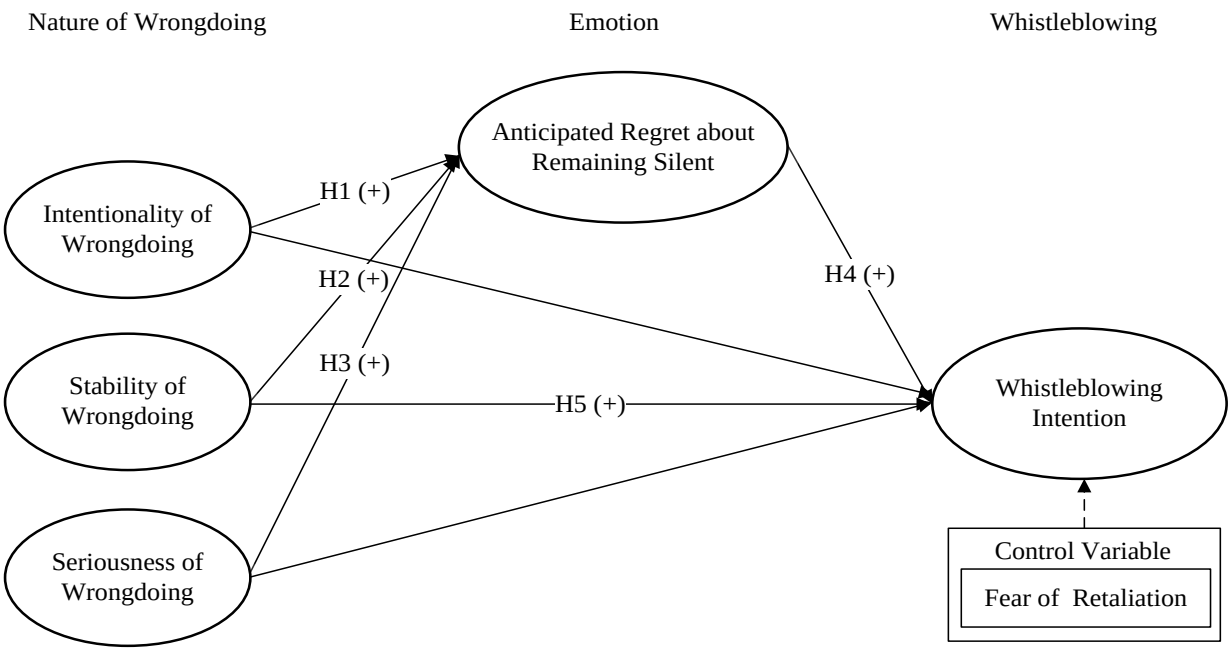


Figure 1. Research Model for Study Two

seriousness of wrongdoing, and emotion in shaping individuals whistleblowing behavior in the context of health information privacy violations (see Figure 1). Based on a laboratory experiment in which intentionality of wrongdoing and stability of wrongdoing were manipulated independently, we found that both factors played a critical role in shaping anticipated regret about remaining silent, which in turn influences whistleblowing intentions in the context of health information privacy violations. We also found that the effect of seriousness of wrongdoing on whistleblowing behavior was partially mediated by anticipated regret. Implications for research and practice are discussed.

1.3.2.1 Contributions

This study contributes to the literature in several important ways and represents the first attempt to investigate: (1) how the nature of wrongdoing (intentionality, stability, and seriousness) affects anticipated regret about remaining silent, and (2) how an important emotion (anticipated regret about remaining silent) influences whistleblowing intentions. Our study also confirms the

direct effects of intentionality and seriousness of wrongdoing on whistleblowing intentions. Finally, our study is the first to systematically investigate whistleblowing within the context of health information privacy violations.

1.3.3 Study Three

IS project managers need to make decisions on the extent of process documentation (contextualized, generalized, or no process documentation) in every IS project. This documentation helps preserve the rationale behind critical decision made during various lifecycle stages. While the usefulness of process documentation in significantly reducing maintenance costs (Ramesh and Dhar 1992), facilitating communications among business partners (Biemborn et al. 2008), and conserving an organizations' resources (Lethbridge et al. 2003) has been documented, the uncertainty associated with the realization of these benefits makes the decision to invest in process documentation very challenging. Under uncertainty, decision makers generally compare and evaluate their decision alternatives based on reference points (Kahneman 1992; Lin et al. 2006a). The psychological comparison process, called counterfactual thinking, creates anticipated regret (Hetts et al. 2000; Lin et al. 2006a). In prior research, the role of anticipated regret in the decision to invest in process documentation, and the role of requirements uncertainty, accountability, and the type of project (traditional vs. agile) in shaping this anticipated regret have not been explored.

Based on the notions of regret aversion (Zeelenberg et al. 1996; Zeelenberg and Pieters 2007) and reference points (Kahneman 1992; Lin et al. 2006a), we investigate following research questions: *How do requirements uncertainty, accountability, and the type of project (traditional vs. agile) influence anticipated regret about creating contextualized, generalized, or no process documentation, and in turn, the decision to invest in this documentation?* We examine this

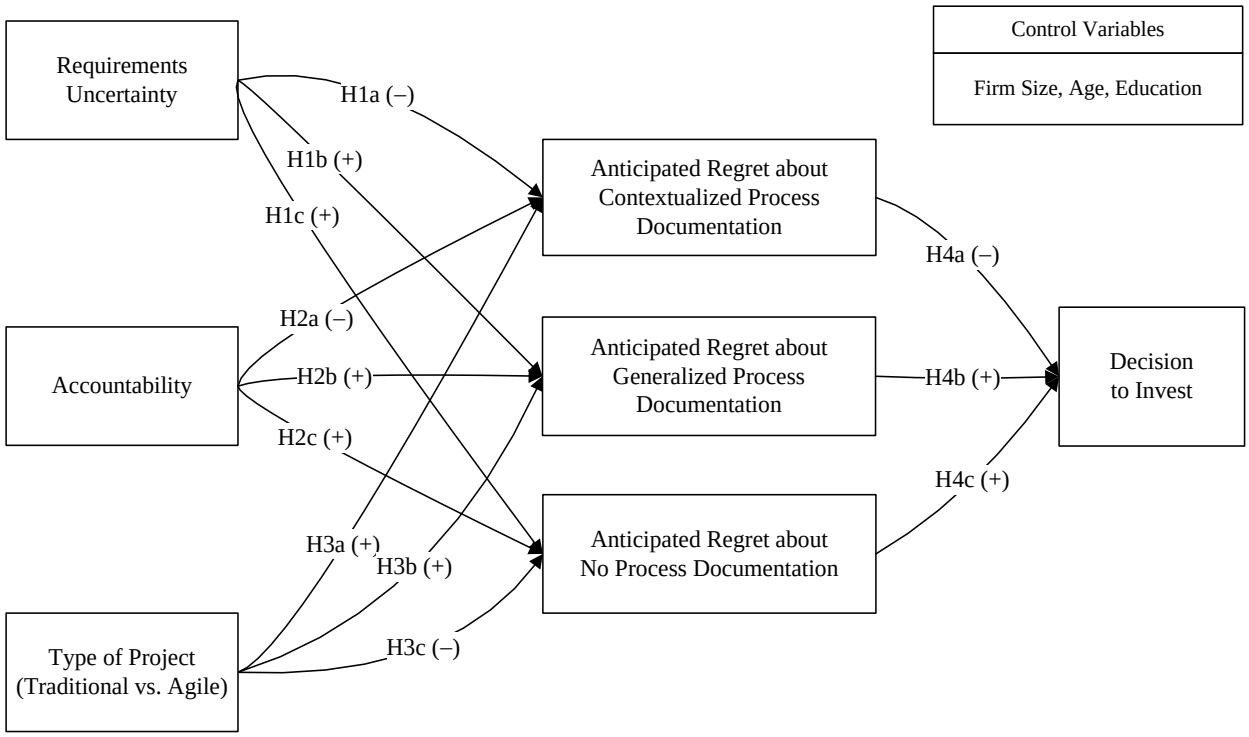


Figure 2. Research Model for Study Three

Note: H1c (*) indicates that regardless of increasing or decreasing requirements uncertainty, anticipated regret is constantly high.

question using the research model (shown in Figure 2). An experimental study with IT project managers are used to evaluate the hypotheses presented in Figure 2.

1.3.3.1 Contributions

This study is the first attempt to investigate the following relationships and contributes to the IS literature in significant ways: first, how requirements uncertainty affects both anticipated regrets about choosing contextualized process documentation and no process documentation; second, how accountability influence anticipated regret about three types of process documentations; third, how the type of project (traditional or agile) affects anticipated regret about three different types of process documentations; and finally, how anticipated regret about contextualized process documentation and no process documentation influence decision to invest in process documentation.

In the following chapters, details of the three studies are presented.

Chapter 2

A Framework for Understanding the Role of Regret in IT Real Options Decision Making

2.1 Introduction

Emotion plays a significant role in investment decisions made under uncertainty (Lazarus 1991). People with positive emotions such as happiness and joy tend to continue or expand their investments through repurchase (Bagozzi et al. 1999). People with negative emotions such as regret that result from experienced or anticipated consequences of their investments tend to plan more vigilantly, modify their plans, or avoid making decisions (Hoelzl and Loewenstein 2005; Zeelenberg and Pieters 2007) even though they are typically not very well aware of the influence of their emotions on their decisions (Bazerman 2006). While emotion significantly affects information technology (IT) real options thinking (Lankton and Luft 2008), which is a way of valuing IT investments, its role has been largely overlooked in prior IS research.

A real option indicates "the opportunity without an obligation to take some action in the future in response to endogenous or exogenous developments" (Tiwana et al. 2007, p. 159). In the context of IT investments, real options correspond to the flexibility in scope, schedule and the implementation approach used (Fichman et al. 2005, p. 75). Prior research on IT real options decision making has primarily relied on models of cognitive processes that examine perception, judgment, and reasoning (such as signaling effects and bounded rationality) (Tiwana et al. 2006; Tiwana et al. 2007). Although cognition-based models significantly contribute to the

understanding of decisions made by IT decision makers (Sengupta and Te'eni 1993), some unique characteristics of IT investments make cognitive evaluation of IT real options difficult. For example, some payoffs from IT projects occur indirectly through improvements in business processes and therefore, cannot be readily evaluated. IT infrastructure investments provide long term payoffs that are not easily measurable (Brynjolfsson and Hitt 1998). Since cognition-based models of decision making are not sufficient to fully explain decisions and behaviors, the need to take into account the role of emotion is gaining attention in the literature (Beaudry and Pinsonneault 2010). Since according to Jones (2003, p. 397),"cognitive and emotional constitutions concomitantly promote and interfere with goal directed behaviors," it is important to examine the role of emotion in goal directed behaviors such as IT investment decision making. In the context of IT real options decision making, cognitive activities such as analyzing costs and benefits of forgone outcomes may elicit emotions that lead to a decision or a behavior (Lankton and Luft 2008). For example, decision makers often rely on their gut feeling or managerial intuition, which is based on emotions (such as regret). Bazerman and Moore (2009) emphasize the need for developing a clear understanding of how emotion influences decision making because it can help decision makers improve the quality of their decisions. Motivated by the need for more research in this area, the goal of our research is to understand how emotion influences IT real options decision making.

We investigate the role of a specific emotion, namely regret. Regret is defined as "an aversive, cognitively based emotion that people are motivated to regulate" (Zeelenberg and Pieters 2007, p. 15). Prior research suggests that regret plays a critical role in individual's investment decisions in a variety of contexts such as managers' decisions on retaining earnings for investments (Ghosh 1993), investments in risky or safe financial investment options

(Zeelenberg and Beattie 1997), and taking over an investment from another investor (Hoelzl and Loewenstein 2005). Specifically, regret influences decision makers' valuation of IT real options (Lankton and Luft 2008). These studies suggest that regret theory is an appropriate lens to understand the dynamics of how this emotion influences IT real options decisions made in uncertain environments. Thus, our study is guided by the following research question: *how does regret impact IT real options decisions?*

We answer this question through a multi-site case study and by drawing from the literature on regret and real options theories. Specifically, we study real options decision making in the context of investments in Radio Frequency Identification (RFID) technology in public libraries. RFID tags transmit the identity and other data about an object using radio waves. They are widely used in many areas such as asset tracking, manufacturing, supply chain management and retailing. Investment in RFID in libraries is characterized by a variety of uncertainties. Further, decisions about investments in different components of the RFID technology are often made in stages in libraries. Therefore, this context offers multiple decision points to study IT real options decision making under uncertainty and thus is an excellent candidate for our study.

Our study represents one of the first attempts at conceptualizing the impacts of regret in the context of IT real options decisions. This research contributes to the literature streams on regret and IT real options decision making. It highlights how IT investment decision makers take into account both past experiences that resulted in experienced regret and future expectations of anticipated regret while making their decisions. We develop a framework that explains how regret is triggered by uncertainties in the environment, and how the strategies that are used to regulate regret influence the valuation, creation, or exercise of specific real options. The rest of the paper is organized as follows: First, we discuss prior literature on real options and regret

theory. We then present the research methodology and our results in the form of a framework. Finally, we discuss our findings and conclude with contributions to theory and practice.

2.2 Theoretical Background

2.2.1 IT Real Options

IT real options exist "whenever an IT project has flexibility about which applications and functions to implement, and when or how to implement them" (Fichman et al. 2005, p. 75). On the basis of flexibility available to decision makers in IT projects, prior research has identified six types of real options (Fichman et al. 2005, p. 80): (1) growth (an initial baseline investment unlocks a variety of potential opportunities of follow-on IT investments); (2) stage (a project can be divided into distinct stages where pursuit of each stage is contingent on a reassessment of costs and benefits at the time the preceding stage is completed); (3) change scale (the allocated resources to be contracted or expanded or operational system enabled by a project can be scaled up or down); (4) switch (switch use -- an IT asset developed for one purpose can be redeployed to serve another purpose, or switch input -- a key foundation technology supporting a project can be swapped out for another); (5) defer (a project can be deferred for some period without imperiling the potential benefits); and (6) abandon (a project can be terminated midstream).

Prior research identifies two different approaches to real options decision making that are used in practice (Lankton and Luft 2008). The first approach, broadly called formal real options analysis (Benaroch et al. 2007; Tallon et al. 2002; van Putten and MacMillan 2004) employs techniques that are typically used to value options in financial securities (such as the Black-Scholes or binominal models (Tallon et al. 2002) (Tallon et al. 2002). While this approach may be theoretically better, its implementation is often very complex and is subject to errors resulting from inappropriate assumptions made by decision makers as well as the use of inappropriate

methods for estimating model parameters (Lankton and Luft 2008, p. 204). The second approach, broadly called 'real options thinking,' which is the focus of this study, is a heuristic approach that involves "intuitive managerial judgment structured by the basic option-pricing principles" (Lankton and Luft 2008, p. 204). While managers often gain insights from real options theory (Fichman et al. 2005), their decision making does not correspond to the exact steps used in option-pricing models (Benaroch et al. 2006; Tiwana et al. 2007).

Prior studies suggest that such intuitive judgment is vulnerable to potential pitfalls and is likely to be associated with systematic biases in the valuation of real options (Fichman et al. 2005). Several attempts have been made to explain the causes of the biases by developing models of 'cognitive' processes involved in the decision. Prior studies suggest that signaling effects, framing effects, and anti-failure bias may be the possible reasons why managers value certain option types more than others (Tiwana et al. 2006). Also, bounded rationality of decision makers may lead to biases (Tiwana et al. 2007). While prior studies identify several cognitive causes of systematic biases, the role of emotion which influences intuitive managerial judgment is also gaining recognition in the literature (Hanoch 2002; Kaufman 1999; Simon 1987). Recent research (Lankton and Luft 2008) suggests that exploring non-cognitive, emotional processes, particularly regret, can shed new light on the fundamental mechanisms governing the valuation of real options. Our study seeks to examine how regret impacts IT real options decisions.

2.2.2 Regret in Decision Making

Regret is an unpleasant emotion, which is associated with a sense of self-blame about the negative outcomes caused by a certain decision or behavior. On the other hand, it is a powerful emotion, raised with strong wishes to either undo a current situation or change a future situation and is strongly linked to decision making (Reb 2008). Since decision makers are motivated to

avoid regret, their experience of regret can shape their decisions and behaviors (e.g., Bell 1982; Lin et al. 2006b; Pornpitakpan 2010).

Regret can be classified as experienced regret and anticipated regret. Experienced regret occurs when people think retrospectively about their past experiences and realize that the current situation could be better if they had pursued different alternatives or actions (Kahneman and Miller 1986). Thus, a poorly chosen alternative's outcome compared with a forgone alternative's outcome triggers experienced regret (Reb 2008). In contrast, people experience anticipated regret "when the most preferred alternative is not necessarily superior to another alternative" and "when the negative consequences that might ensue from the decision could start to materialize almost immediately after the decision is made" (Janis and Mann 1977b, p. 223). Anticipated regret occurs when the situation is uncertain and a decision is important and difficult (Zeelenberg and Pieters 2007).

The evaluative process that has been well recognized as a trigger of experienced regret and anticipated regret is called counterfactual thinking (Epstude and Roese 2008), which is generally expressed as conditional proposition. Counterfactual thinking involves a mental simulation on aspects of a past event, in which people compare "the actual outcome with what the outcome would have been, had a different choice been made" (Zeelenberg and Beattie 1997, p. 64). Here, 'counterfactuals' indicate thoughts about alternatives to past outcomes (Roese 2000, p. 277). People think about the real outcome that has happened and imagine what it might otherwise have been. Experienced regret is generated when the counterfactual outcome of a forgone alternative is better than the actual outcome of a chosen alternative (Inman et al. 1997). On the other hand, counterfactual thinking involves a mental simulation on aspects of a future event, in which people engage in anticipating 'potential counterfactuals,' which are thoughts about alternatives to

future outcomes (Hetts et al. 2000). Before a decision is made, people compare possible outcomes with counterfactual alternatives (Byrne and Egan 2004; Hetts et al. 2000). Counterfactual thinking has also been shown to influence an individual's emotional reaction to possible predicted outcomes by generating anticipated regret (2003; Hetts et al. 2000; Simonson 1992b).

Regret has the unique characteristics mentioned above, which make its role in decision making interesting. Regret theorists call regret a 'cognitive' emotion (Zeelenberg and Pieters 2007) or 'counterfactual' emotion (Roese and Summerville 2005) because it is triggered by cognitive processing of information such as counterfactual thinking. The relationship between cognitive processing and regret has been confirmed by neuroimaging studies (Camille et al. 2004; Coricelli et al. 2005). Camille et al (2004) who examine whether cognitive processes trigger regret find that patients who have damaged orbitofrontal cortical do not anticipate negative consequences of their decisions and therefore do not experience regret. The orbitofrontal cortex, which is known to be responsible for decision making associated with calculating costs and benefits (Bechara et al. 1994), plays a critical role in triggering the experience of regret.

Regret theory has been applied to decision making in many areas such as consumer purchase decisions (Simonson 1992b), investment decisions (Lankton and Luft 2008; Lin et al. 2006b), financial decision making (Ghosh 1993; Hoelzl and Loewenstein 2005; Zeelenberg and Beattie 1997), and escalation in project management (Ku 2008; Wong and Kwong 2007). For instance, in the investment decision making context, prior studies find that the regret experienced by investors is influenced by evaluating "what their outcomes might have been had they not invested" as well as expected outcomes and the outcomes of "unchosen" investments that performed the best (Lin et al. 2006b). Investigating the escalation of projects, Wong and Kwong

(2007) find that regret impacts escalation. Escalation of commitment is stronger with higher anticipated regret about withdrawal than with lower anticipated regret. In IT real options decision making, Lankton and Luft (2008) find that anticipated regret influences decision makers to value deferral options highly but not growth options as uncertainty increases, although uncertainty should normatively increase the values of both option types. They argue that managers' gut feeling that originates from regret is an important determinant of real options decisions. Although they suggest that regret theory may explain behaviors related to IT real options decision, this topic has received inadequate attention in the IS literature.

2.2.3 Regret Regulation Strategies

Regulation strategies are behaviors that decision makers use to manage their emotion through not only expressive behavior but also instrumental behavior (Inman 2007). An expressive behavior "establishes or enhances, weakens or breaks, some form of contact with some aspect of the environment or that aims at doing so or is accessory in doing so" (Frijda 1986, p. 13) through bodily or facial expressions. Instrumental behavior originates from action tendency, and tries to achieve desired changes or maintain desired states with a specific purpose. Instrumental behaviors can be generated as responses to experienced or anticipated negative outcomes or events (Frijda 1986). A major function of instrumental behaviors is to cope with negative emotion-eliciting events (Frijda 1986; Lazarus 1991). In regret theory, regulation related to instrumental behaviors is an especially important notion. Since people are typically regret averse, when they experience or anticipate regret, they seek to overcome it and regulate it through instrumental behaviors (Janis and Mann 1977b; Pieters and Zeelenberg 2005). Zeelenberg and Pieters (2007) suggest three types of instrumental behaviors to prevent future regret and manage current regret: (1) decision-focused strategies are centered on the decision process and its

outcomes (e.g., increase decision quality and justifiability); (2) alternative-focused strategies are centered on alternatives that were not chosen (e.g., reappraise alternatives); and (3) feeling-focused strategies are centered on reducing the experience of regret feeling (e.g., deny regret). Inman provides additional regret regulation strategies (2007, p. 22-23): reducing emotional stress from possible current or future regret-causing feedback; encouraging the achievement of goals and tasks; and keeping long-term integrity of personal systems (e.g., personal goals, motives).

2.2.4 Environmental Uncertainty

Environmental factors can play an important role in determining why decision makers experience negative and positive emotions. Prior research in psychology on emotion-inducing processes suggests that environmental factors such as thought, action and resource constraints precede emotion (Lazarus 1991; Oatley 1992). During an emotion-inducing process, an individual evaluates whether the experienced or anticipated consequence of an environmental factor harms or benefits his/her goals and wellbeing (Frijda 1993; Ortony et al. 1999).

Uncertainty in the environment also has been shown to influence regret experienced by decision makers (e.g., Bell 1982; Loomes and Sugden 1982b; Quiggin 1990; Zeelenberg and Pieters 2004). Real options literature (Benaroch and Kauffman 1999; Tiwana et al. 2007) highlights that "real options are more valuable under greater uncertainty based on the premise that the managerial flexibility provided by real options is of value when there is considerable uncertainty surrounding a project. However, uncertainty is a necessary but insufficient condition for managers to ascribe value to real options" (Tiwana et al. 2007, p. 160). Ghosh (1993) finds that when investment opportunities are uncertain, regret aversion leads managers to prefer paying higher dividends rather than retaining funds for investments and to even pay dividends using borrowed funds. Lankton and Luft (2008) find that uncertainty influences intuitive

decisions that are based on anticipated regret. For example, high uncertainty is more likely to lead IT decision makers to prefer deferral options to growth options.

In summary, our review of literature suggests that a detailed understanding of the relationships among environmental uncertainty, regret, and regret regulation strategies can provide meaningful explanations on why, how, and when people choose the course of actions taken in a specific context (Beaudry and Pinsonneault 2010; Ortiz de Guinea and Markus 2009). Our research seeks to develop this understanding in the context of a critical problem in the IS domain, namely IT real options decision making.

2.3 Research Methodology

Our research seeks to develop an understanding of the role of regret in IT real options decision making by developing a framework which is presented as a process model. Prior research on regret mostly adopts a variance (or factor) model approach that explains the variance in the dependent variables with independent variables. However, they do not seek to "provide evidence of the phenomena (events, actions, and so on) that link the independent and dependent variables" (Newman and Robey 1992, p. 250). In contrast, a process model "focuses on sequences of events over time to explain how and why particular outcomes are reached and provides the story that explains the degree of association between predictors and outcomes" (Newman and Robey 1992, p. 250-251).

Since our approach is exploratory rather than confirmatory, we use a case study design (Yin 2003). While building theory from case study research is commonly done in the early stages of research on a topic, Eisenhardt (1989) suggests it can be used to "provide freshness in perspective to an already researched topic." The use of the case study approach is appropriate to inductively develop a framework (Eisenhardt 1989) that explains the role played by emotion in

IT real options decision making. A multi-site case permits a "replication logic" (Yin 2003) in which the cases are treated as a series of independent experiments that confirm or disconfirm emerging conceptual insights and enables us to enhance generalizability (Miles and Huberman 1994).

The selection of the study sites was driven by purposeful, theoretical sampling (Glaser and Strauss 1967; Yin 2009) – i.e. the potential to investigate the role of regret in IT real options decision making. We selected public libraries as the study setting because the decision making process in public organization involves factors that make cognitive evaluation more difficult than in private organizations. The outcome of an investment is usually not measured in economic terms only but includes other considerations such as serving public interests whose benefits are difficult to quantify in economic terms. As a result, the impact of emotion in decision making in public organizations such as public libraries may be more pronounced because studies suggest that in public organizations the decision makers are "well acquainted and emotionally involved with the problem" (Mahler 1987). Therefore, they offered a theoretically relevant organizational context for our study. They also offered opportunities for disconfirming our expectations that regret plays a role in real options decision making because of the diverse nature of the outcomes of the decisions made in the focal organizations – ranging from decision not to invest to decision to invest in stages to full-fledged adoption of the technology (Dube and Pare 2003; Markus 1989). The selection of our case study site is consistent with the notion of "information oriented selection" to maximize the utility of information from smaller sample (Flyvbjerg 2006). The organizational stakeholders also had different sets of goals for the services that they sought to offer to their clients and were operating in different settings – two libraries that served the general public and two others educational institutions. The case study sites provided access to

stakeholders representing multiple perspectives in the IT investment decision making process. They had both positive and negative experiences which provided the data needed for the development of our framework.

Libraries are increasingly investing in RFID technology because of its potential to offer significant benefits such as improved operational efficiency and better control against theft, non-returns, and misfiling of library assets (Boss 2004; Coyle 2005; Ting-Peng and Tanniru 2006). However, investments in RFID technology in public libraries face uncertainties caused by the relatively high cost, the lack of standardization or maturity of the technology infrastructure, and the difficulties with integrating it with critical applications. Since uncertainties in the environment are often associated with emotion-based decision making, these characteristics of investments in RFID make it an appropriate technology to study the role of emotion in IT real options decision making. Thus the study sites and the technology provided a sufficiently rich context to study the role of regret in IT real options decision making. The unit of analysis in this study is at the individual level – we investigate individual's decision making process and the actions taken in response to the emotions experienced or anticipated by them.

2.3.1 Data Collection

Data were collected using semi-structured interviews with key stakeholders involved in making decisions about investing in RFID technology. They include the directors, senior managers (public service managers and service department managers), library branch managers, IT staff, and system analysts. Each of these individuals was responsible for the real options decisions in some aspects of the RFID project in their respective organizations. Our study focused on understanding the role of regret in the decisions for which each individual was responsible.

Table 1. Respondents in the Study

Respondents	VLibrary (V)	SLibrary (S)	TLibrary (T)	CLibrary (C)	Total
Director (D)	1	1	1	1	4
Senior Managers (Public Service, Service Department, Acquisition Managers) (M)	4	6	5	2	17
Library Branch Manager (B)	2	7	3	1	13
IT Staff / Systems Analyst (I)	2	2	2	1	7
Total	9	16	11	5	41

Note: The capital letter indicates an acronym that is used to specify a source of a respondent in the result section.

Table 2. Regret and Regret Regulation Strategy Items (adopted from Roseman et al. (1994) & Zeelenberg et al. (1998; 2000))

Response Type	Description	Response Item
Feelings	A broad range of feelings that includes feeling states (moods and discrete emotions) and feeling traits (positive and negative affectivity)	• Feels a sinking feeling • Feels that s/he should have known better
Thoughts	Arrangement of ideas that result from mental thinking process during an event	• Thinks about a mistake • Thinks about a lost opportunity
Motivational Goals	The end result toward which people are striving or moving	• Wants to undo an event • Wants to get a second chance
Action Tendencies	An impulse or inclination to respond with a particular action	• Feels like kicking himself/herself • Feels like correcting his/her mistakes
Actions	The result of acting or activity	• Does something differently • Changes the situation

Internal documents such as policy reports were used as complementary sources of secondary data. We also observed how RFID was used in the libraries, for example, in the self check-out process. Table 1 lists the positions of respondents and the number of interview conducted.

Since our study examines decisions that were influenced by regret rather than cognition-focused approaches such as cost-benefit analysis, our data collection was centered on understanding the role of regret in shaping IT real options thinking. For this purpose, we employed the approach used by Roseman et al. (1994) and Zeelenberg et al. (1998a; 2000a).

Table 3. Excerpt from the Interview Guide

- What were the goals of your investment decision in RFID technologies?
- What were the consequences (both positive and negative) of RFID on your customers, employees and your organization?
- Did RFID technology bring changes in business processes to your organization?
- What kinds of uncertainties were considered in IT investment decision making?
- How did the decision making process improve managerial flexibility for the decision makers when considering when and how to invest in different components of the RFID technology?
- What were the major organizational changes that were observed after investing in RFID?
- How did you use the data which were collected through the use of RFID?
- Describe your feelings, mental thought processes, action tendencies, desired actions, and motivations related to RFID investment decision making (seek clarifications and details when the respondent makes statements about a sinking feeling, regret, mistakes made, felt like kicking him/herself, wanted to correct his/her mistakes, or get a second chance – either experienced or anticipated)
- What kinds of strategies or actions were used to minimize the regret related to RFID investment decision making when your decisions did not produce the expected results?
- When RFID didn't work as planned, what back up plans did you have to maintain business continuity?
- What were the critical events that shaped your investment decision in RFID technology?

Regret is expressed in terms of feelings, thoughts, and motivational goals. Regret regulation strategies include action tendencies and actions (Table 2).Our data collection specifically focused on capturing these regret and regret regulation experiences expressed by the respondents in their description of the IT real options decision making. The interviews were audio recorded and transcribed when feasible or detailed notes were taken. Each interviews lasted approximately 90 minutes, on average. An excerpt from our interview guide is provided in Table 3.

2.3.2 Data Analysis

Data collection was tightly interwoven with data analysis. Indeed, both activities occurred simultaneously. As interviews were conducted, the transcripts were analyzed. Preliminary results helped identify additional participants and helped refine the interview questions (Strauss and Corbin 1994). The concepts identified from literature on regret theory (environmental uncertainty, anticipated regret, experienced regret and regret regulation strategies) and IT real

Table 4. Evidence Included in the Analysis Matrix

Type of Evidence	Description	Sample Quotes
Environmental Uncertainty	Uncertainties that include information technology and IT project uncertainties.	*"It was not clear whether the new software could be readily integrated with the ILS."*
Anticipated Regret	Emotion occurred when decision makers think that the most preferred alternative is not necessarily superior to another alternative.	*"I had a sinking feeling that I may be making the wrong decision even though RFID was a technology of the future as RFID might not work as I expected."*
Experienced Regret	Emotion occurred when decision makers think retrospectively about their past experience and realize that the current situation could be better if they had pursued different alternative options or actions.	*"The failure of the security gate was a huge embarrassment...I felt I was instrumental in making this major mistake."*
Regret Regulation Strategies	Behaviors that decision makers use to manage experienced regret and anticipated regret in order to achieve their goals or feel better.	*"I am willing to wait rather than jump into another technology that is not mature yet."*
Valuation, Creation, or Exercise of IT Real Options	Valuation, creation, or exercise of a real option that indicates the opportunity without an obligation to take some action in the future in response to endogenous or exogenous development. In the context of IT investments, real options correspond to the flexibility in scope, schedule and the implementation approach used.	*"We decided that we could switch back to barcode when needed."*

options thinking (IT real options) served as seed concepts in our initial coding of data. Our data analysis helped refine and/or modify these concepts and identify the relationships among them and guide the next round of data collection. Data collection and coding were done till 'theoretical saturation' was reached (Eisenhardt 1989), when additional data did not add to the concepts and categories developed.

Transcripts of interviews constitute the primary data in this study. The data analysis focused on identifying key concepts, categories and relationships. Our respondents were encouraged to articulate their experiences in the form of narratives or stories. This allowed us to represent the concepts into a temporal sequence that depicts the processes used in IT real options decision

making. Initially, the researchers separately analyzed each case for evidence. This evidence was summarized and entered into a matrix created for intermediate qualitative data analysis (see Table 4 for an excerpt). The researchers also actively searched for any new concepts and relationships that emerged. Then the results were debated and modified until the researchers reached agreement.

The data analysis helped discover categories, relationships, and patterns in the data which form the basis of our framework. Based on similarities and differences among the concepts, concepts were revised and merged to better represent the underlying meaning. These concepts were further validated and/or clarified by data from subsequent interviews. As Strauss and Corbin (1990) suggest, theoretical relevance of concepts is indicated by their repeated presence or notable absence when comparing incidents. No attempt has been made to statistically evaluate the strength of a concept. As long as a concept is not contradicted by the data, it is considered to be valid. Though the findings from such analyses are detailed and particularistic, they can be used to develop a general explanation of the results (Eisenhardt 1989; Orlikowski 1993) through analytic generalization (Yin 2003). Our framework was presented to key informants in the sites and minor adjustments were made to the terminology used in the framework on the basis of their feedback.

2.3.3 Study Sites

RFID technology is a combination of radio-frequency and microchip technologies. Information contained on microchips in the tags that are affixed to library materials is read using radio frequency technology. The tags can be read from a distance of up to two feet and they need not be in the line-of-sight as required by barcode systems. RFID technology can process multiple items simultaneously, and thereby improve operational efficiency. Components of RFID

technology are described in Appendix A. Investment in these RFID components may be done in multiple stages. Therefore, the study sites provided multiple decision points to understand IT real options decision making. The study sites are briefly described below and more details are presented in Appendix B.

The VLibrary system provides free access to information and materials to the public in a city in the northeastern part of USA. In nine branches, RFID check-in, check-out and a security system were implemented. In addition, seven of these branches installed self check-out counters. However, a barcode was still used to identify a specific copy of an item. Other components such as automatic check-in and material handling were scheduled to be adopted in future stages. The inventory control component was implemented but it did not function as expected.

The SLibrary system is among the largest public library systems in the southern USA with fourteen branches. It had invested over $1.2 million in RFID technology initially and had plans to roll out the technology in the entire system after evaluating this implementation. The initial implementation includes self check-out, check-in, inventory control and a security system. SLibrary decided not to invest in automatic check-in, and material handling components.

The TLibrary system serves an internationally reputed public university in the USA. It serves nearly 20,000 students, academic faculty, research staff and other professionals. While the library evaluated the potential use of RFID technology, it decided against investing in this technology for a variety of reasons. While TLibrary is well known for its technological leadership, its strategic plan called for a focus on digital rather than physical collections. Therefore, decision makers had concerns about the long-term impacts of RFID technology on the operations of the library. In addition, they were also concerned about the lack of maturity of the technology at the time the investment decision was made.

The CLibrary serves a newly created university that was formed by merging smaller educational institutions. It moved into a new campus that included a modern library building. The library had the opportunity to include the RFID project as a part of the budget for the new building. Further, it also had the opportunity to create physical infrastructure that would facilitate the use of RFID technology. Since it was purchasing nearly half of its collection, it had the rare opportunity to incorporate RFID in all aspects of its operations. It adopted most of the available components of the RFID technology when the new library building was inaugurated.

2.4 Results

2.4.1 Our Framework

We have developed a framework (shown in Figure 1) based on the analysis of data collected from the four sites described above. Our framework includes the following events involved in IT investment decision making that explain the role of regret in IT investment decision making: Anticipate or Experience regret; Regulate anticipated or experienced regret; and Value, create, or exercise IT real options. Our framework also represents the context, in which IT investment decisions are made, namely environmental uncertainties (i.e., information technology and IT project uncertainties) that influence anticipated or experienced regret. Sub-categories of these concepts and the interactions among them emerged from our data. Our framework is described in detail in this section and is briefly summarized as follows.

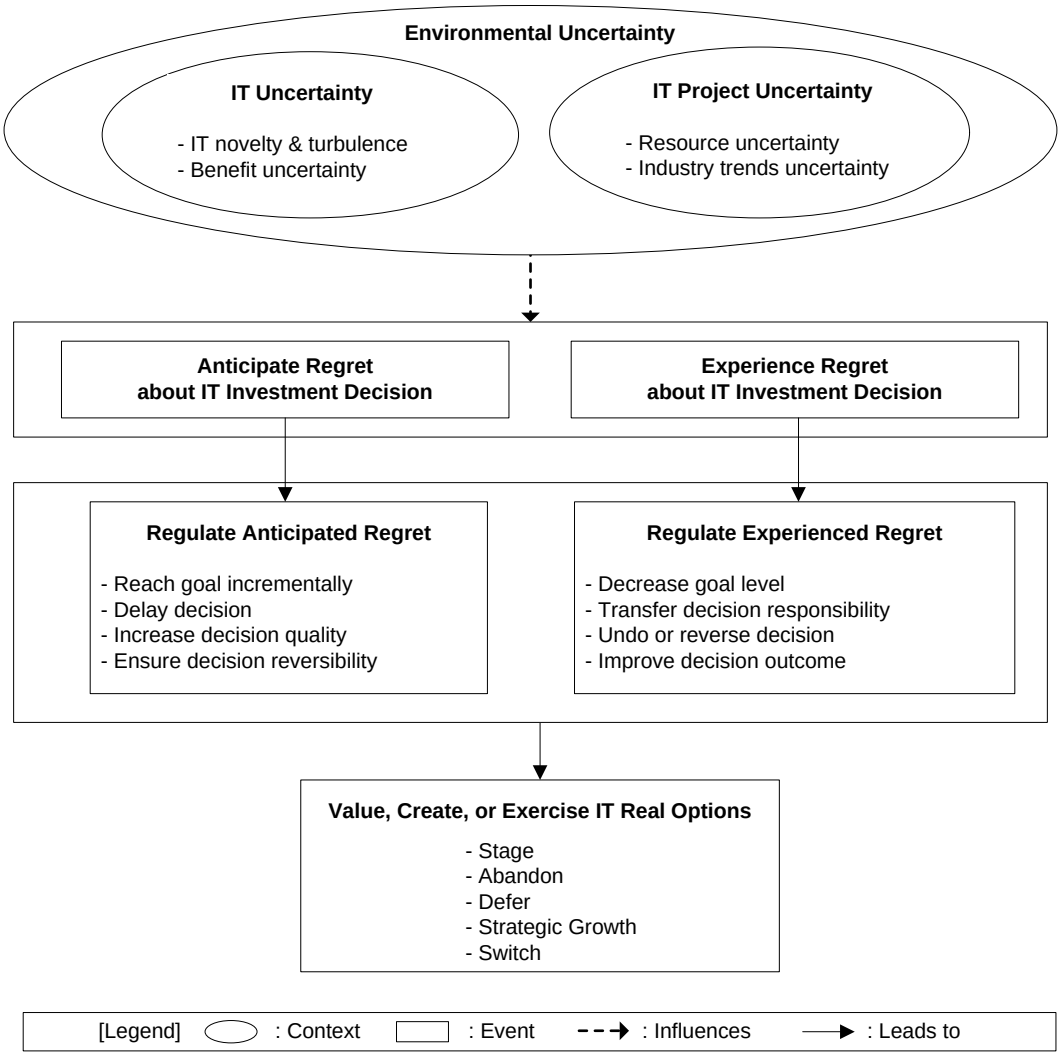


Figure 1. Our Framework

Anticipated regret of decision makers about their IT investment decision is influenced by uncertainties in the environment such as IT uncertainty and IT project uncertainty. Decision makers use regret regulation strategies to manage their anticipated regret. These strategies lead to the valuation, creation, or exercise of IT real options. After the decision is made, decision makers experience regret if negative outcomes of the decision are realized, They use regret regulation strategies to manage their experienced regret which in turn lead to the valuation, creation or exercise of IT real options.

While our discussion on anticipated and experienced regret is presented sequentially, it should be noted that some decision makers may experience only one type of regret while others may experience both (i.e., only anticipated regret, only experienced regret, or both anticipated and experienced regret). Below, we explain our framework in detail.

2.4.2 Context: Environmental Uncertainty Influencing IT Investment Decision

The environmental uncertainties that have significant impact on RFID investment decision include IT uncertainty and IT project uncertainty.

2.4.2.1 Information technology uncertainty

In each focal organization, the characteristics of the RFID technology introduced uncertainties in investment decision making. RFID technology which was in its early stages of development when the focal libraries considered their investments posed uncertainties due to the novelty and turbulence of the technology and about the benefits of the technology.

IT novelty and turbulence: The use of RFID in libraries was not widespread when the focal libraries were making their investment decisions. A policy report from VLibrary recognized the strategic nature of the investment in RFID: *"Self-service check-out and RFID inventory control are infant industries, and they represent an investment in the future."* It was considered a very novel technology by the decision makers and it required investments in new hardware, software and infrastructure. There was also uncertainty about the custom software that had to be developed to integrate the data collected by RFID readers with existing information systems. *"[RFID technology] touches every item in [the] collection*" *"It was not clear to me whether the new software could be readily integrated with the ILS [Integrated Library Systems]" (VI)*[2].

[2] Hereafter, direct quotes from respondents are shown in italics within quotation marks. They are identified with a two letter code representing the organization and the role of the informant (as noted in Table 1). For example, VI represents a quote from a VLibrary (organization) IT Staff / Systems Analyst (role).

RFID technology was believed to be still evolving at the time of its evaluation by all the organizations. The turbulence of the technology itself was considered the most critical issue in the investment decision, as described in the policy report of VLibrary: *"The cost of this equipment will decrease, and its availability will increase dramatically in the near future."* TLibrary was also concerned with the issue of evolving technology and decreasing cost. *"I was told by some researchers that…more powerful and cheaper options will become available in the market in the near future" (TM).*

Benefit uncertainty: Some decision makers believed that RFID would provide relative advantages over the barcode technology that was being used. However, they were not sure about the extent of some of the specific benefits provided by this technology. For example, while the director of the VLibrary was convinced about the long-term potential of the technology, she was less certain about the immediate improvements in operations such as enhanced throughput, increased quality of service, and improved efficiency in material handling. Similarly, in SLibrary, *"The library did not set very specific goals about critical things like the accuracy of alarms, the reliability of the check-out process... I am not sure I could be more specific about these performance metrics because I was not sure what the technology can deliver" (SB).* The director of the TLibrary was not sure that RFID would deliver significant value when collections were becoming digital. *"[The library was] moving in the direction of digital collections rather than physical collections. This was part of our strategic plan. So, I feel that investments in RFID type of technologies that are helpful with physical collections are not likely to yield benefits in the long term" (TD).*

2.4.2.2 IT Project uncertainty

Uncertainties in the project environment also influenced RFID investment decision making.

Resource uncertainty: There were considerable uncertainties about the availability of resources needed to invest in RFID. While the number of patrons was increasing, there were major budget cuts in the focal organizations that could impact the RFID projects. Other resource uncertainties such as the availability of necessary expertise in the technology also influenced the decision making process. Many managers did not fully understand the impacts of RFID on the operations. While they thought that RFID would improve efficiency in comparison with the use of barcodes with its ability to simultaneously process multiple items, they didn't recognize the significant changes that had to be made in the systems and operating procedures for the use of this technology. *"Initially I thought that the major difference [with RFID] is… barcodes you still have to handle every individual item, with RFID, you don't have to handle the items, you put on the antenna and it grabbed them all" (VB). "I am not sure whether this affects the way our daily work performed and the functions of our librarians" (SM).*

Industry trends uncertainty: Decision makers in the libraries were influenced by the uncertainty in industry trends related to the adoption of RFID in libraries. Self-service applications were gaining a lot of adoption in the industry. However, the potential negative consequences of RFID also influenced the investment decision by libraries nationwide. *"I know that there are some concerns on security, privacy, and connectivity to ILS" (VI).* In TLibrary, technology trends caused concerns about investing in RFID: *"We had access to technology experts who had a clear understanding of the technology trajectory which was moving away from its current form" (TD).*

2.4.3 Anticipate Regret about IT Investment Decision

Operating under uncertainty, decision makers engage in counterfactual thinking, which triggers anticipated regret. Counterfactuals are expressed as conditional propositions that specify an antecedent (e.g., *"If I chose A…"*) and an anticipated negative outcome (e.g., *"I would face…"*).

Anticipated regret is expressed in the form of response types identified in Table 2. Some decision makers explicitly expressed their emotion of regret (e.g., *"I might regret…" "I have sinking feeling…"*), while others who might be reluctant to explicitly express their emotions expressed anticipated regret in the form of 'thoughts' about a mistake or a lost opportunity (e.g., "*I have a feeling that I am relying too much on what the vendors say…" "the possibility of getting stuck with obsolete technology because…"*).

Technology novelty and turbulence were considered when evaluating the decision to invest in RFID. *"I was concerned that RFID technology was evolving fast, and may change significantly even in a short period of time" (SD).* Resource uncertainty was considered when the Director of VLibrary was evaluating the costs associated with self-checkout process. *"If I chose self check-out with barcodes, it would cost much less" (VD).*

Decision makers forecasted the outcomes that would result from their choices and identified the possible outcomes for each. This process helped decision makers better understand the consequences of each alternative. For example, potential negative outcome associated with continuing with barcodes (rather than investing in RFID) was a concern for the decision makers. *"Our primary goal was improved customer service. We are not achieving it if we keep the status quo" (SI).*

The option to invest is also better understood when the anticipated regret for investing in RFID is taken into consideration. RFID tags were considered quite expensive and the decision makers were facing the possibility that the cost of the tags might decrease significantly. *"I anticipate that costs for tags could be reduced by as much as half in future years. Later when the tags are much cheaper, I might regret that we spent so much on tags" (VI).* The director of SLibrary who expressed his anticipated regret about investing RFID stated that he had a *"sinking*

feeling that I may be making the wrong decision even though RFID was a technology of the future, as RFID might not work as I expected" (SD). A systems analyst in TLibrary anticipated that he might regret investing RFID rather than investing at a later time because he was concerned about *"the possibility of getting stuck with obsolete technology because the technology was changing rapidly. I didn't want to wonder [later on] whether I should have waited for the [RFID] technology to mature" (TI).* A similar concern was expressed by the director of CLibrary because "*the technology was moving very fast and a lot of improvements have happened in the recent years and I didn't want to wonder later that I missed the opportunity to invest when I had the choice" (CD).*

The above examples show that emotion, specifically anticipated regret, plays a significant role in evaluating investments. Sometimes, intense emotion causes the decision makers to focus only on the possible negative outcome. For example, the director of TLibrary anticipated strong regret about investment in RFID because of his focus on the potential problems with the decision. *"I was not sure about the direction in which this technology is moving. Prices may drop a lot when this technology matures. I had a feeling that I didn't have good answers for these questions" (TD).*

2.4.4 Regulate Anticipated Regret and Value, Create or Exercise Real Options

To regulate the anticipated regret, decision makers used several regret regulation strategies, which had significant impact on the IT real options decisions. These strategies were expressed in the forms of 'action' and 'action tendencies' identified in Table 2. Three libraries (VLibrary, SLibrary and CLibrary) made the decisions to invest in RFID, but TLibrary made the decision not to invest at the current time.

2.4.4.1 Reach goal incrementally strategy: Stage options and Strategic growth options

After the initial decision to invest in RFID technology was made, VLibrary and SLibrary considered the possibility of investing in various components of the RFID technology in phases. The director and the service manager in VLibrary emphasized that their anticipated regret led to their decision to invest in these projects incrementally. *"Considering the technology, we had to adjust the way to achieve our goal. We initiated the RFID investment even though we would not implement all functionalities now" (VD).*

This strategy led to the two libraries to create stage options. VLibrary started with two major elements, self check-out and inventory control, while automated check-in and material handling were considered as "*future elements*" *(VD).* Both VLibrary and SLibrary decided to incrementally invest in self-checkout with RFID in order to mitigate the anticipated regret. *"I wish we could have transitioned all the check-out to self-checkout. I wasn't ready to do it because we didn't know for sure that the technology will work perfectly as advertised. So, we decided to transition in two stages" (SB).*

The stage options were also created for introducing specific components of RFID in each branch of the SLibrary and VLibrary. VLibrary considered investing in RFID one branch at a time. It could be implemented at a new building first and then expanded to other branches based on the feedback from this 'pilot' implementation. *"We could choose a new building [to be the first one to implement RFID]. That was our flagship. We will decide if we will implement the same way in other branches after this one" (VD).*

This strategy ("reach goal incrementally") also impacted the creation of strategic growth options for RFID infrastructure components in both VLibrary and SLibrary. The infrastructure which included tagging equipment, readers, tags, and software provided the foundation for

investing in capabilities such as self check-in and material handling. *"We are looking at self check in and even automatic material handling, in the future" (VD). "Our goal is to move to a fully automated management of our physical collections as we are able to do with our digital content. I want to at least have automated sorting of the checked-in material though the ideal situation will be to have all the movement of our collections fully automated" (SD).*

2.4.4.2 Delay decision strategy: Defer options

The intense regret anticipated by some decision makers caused them to postpone making the decision. This regret was regulated by a "delay decision" strategy. The director at TLibrary decided to delay the investment decision to a later time. His emotions led him to emphasize the negative outcomes that may be realized and he focused on the appropriateness and the cost of RFID without paying adequate attention to the potential benefits. *"It was not clear that RFID could deliver the results we are looking for. Our patrons are looking for capabilities for any place any time access [digital library]… and this technology is not designed for this purpose" (TM). "I wasn't sure the costs will stay this high in the future" (TD).*

This strategy used by the TLibrary director to mitigate anticipated regret, in effect, created the defer option in the project. *"Since we were not very certain about the trajectory that this technology is taking, we wanted to wait until the technology is more stable before committing to a significant investment in the technology" (TD).* As a result of the defer option, the patrons of TLibrary had to use the traditional checkout process, which sometimes caused delays at the checkout counter. A librarian recognized this negative consequence of the decision. *"We are supposed to be a high tech institution. But we are using the age old technology and sometimes it causes delays and frustration for our users" (TL).*

2.4.4.3 Increase decision quality: Defer options

Increasing decision quality by following well-established procedures is another strategy that was used to mitigate anticipated regret. For example, VLibrary and SLibrary had failed to implement the inventory control function in the first phase of the project. When evaluating this investment the next stage, the decision makers followed a cautious approach and engaged in thorough testing in order to increase the quality of their decision. *"Our library jumped into some aspects of the RFID system, maybe too early. I won't do it with the wands for taking inventory control. I want to be more deliberate and test the systems carefully before I commit to it" (SI).*

Decision makers at CLibrary noticed that the requirements specified in their initial request for proposals contained ambiguities that made it difficult for them to evaluate the responses received from potential vendors. Therefore, a revised call for proposals was issued to ensure that the investment decision could be made with better information. *"I wanted to ensure that I had all the relevant information about the possible costs, benefits and challenges before I could make a decision. So, I decided to revise the request for proposals even though it would delay the start of the project" (CD).*

By following this strategy, defer options were created in the three focal organizations. VLibrary and SLibrary decided to defer the implementation of inventory control components. CLibrary decided to defer the project until more detailed information was available on the basis of the revised call for proposals. *"With more detailed proposals, I could make a better decision" (CD).*

2.4.4.4 Ensure decision reversibility: Switch options

To regulate anticipated regret that may result from the failure of RFID, VLibrary and SLibrary retained the barcode system in parallel so that they could revert back to it if necessary.

"Everything is barcoded. … in case there is a problem [with RFID]. Even though it requires a second step in processing the materials, it is a better choice because we anticipated that RFID might not be able to track each item" (VI). "I wanted to make sure that we could continue the operations without much interruption even if the RFID didn't work as anticipated. This [the barcodes] helped us go back to our old set up if and when necessary" (SI).

This strategy provided the decision makers the ability to create switch options in self check-out and check-in components. Specifically, the three libraries prepared for switching back to the barcode technology due to the possibility that RFID may not perform as expected. *"We decided to prepare for going back to barcode when RFID fails. To have both barcode and RFID tag, even though it cost us more but it reduced the risks" (VI).*

2.4.5 Experience Regret about IT Investment Decision

After realizing a negative outcome from a decision, decision makers engaged in counterfactual thinking, which triggers experienced regret. The counterfactual thinking is expressed as conditional propositions by specifying an antecedent (e.g., *"If we had chosen not to replace the security gate…"*) and an alternative outcome (e.g., *"we wouldn't have this issue…"*). The experienced regret is expressed in the form of response types identified in Table 2. The 'feelings' of experienced regret are explicitly expressed by some of decision makers (e.g., *"I regretted…", "I really had a sinking feeling…"*), while others who might be reluctant to explicitly express their emotions expressed experienced regret as 'thoughts' (e.g., "*I was instrumental in making this major mistake."*) or 'motivational goals' about wishing for a second chance (e.g., "*I wish I had a chance to reevaluate the decision to invest in this…*").

While RFID increased operational efficiency by eliminating repetitive tasks in some processes, it was not considered as reliable as barcodes in some situations. *"I wish I had a*

chance to reevaluate the decision to invest in this. We had major problems with the reliability of the technology. We had several cases where the tag itself got damaged" (SM). A senior manager at SLibrary expressed regret over the problems caused by the frequent false alarms that were produced by the security gates. *"We got a lot of flak... the false alarms at the security gate got very sensitive. Instead of this helping us keep a check on our items, we often end up apologizing to the customer" (SM). "If we had chosen not to replace the security gate [with RFID], we wouldn't have this issue [of false alarm]" (SI).* The director and a manager at SLibrary further elaborated: *"It was one of the low points of my career when I had to apologize to a prominent member of our community. The security gate malfunctioned and the alarm went off. Everyone in the area was looking at her as if she was stealing. She didn't take that well and I really wish we had not put that security gate there. I really had a sinking feeling when this happened" (SM). "The failure of the security gate was a huge embarrassment. I really wished that I had not championed that in our meetings. I felt I was instrumental in making this major mistake" (SD).*

Branch managers in both VLibrary and SLibrary regretted that the expected savings in staff costs were not realized. RFID had the potential to free the library staff (whose salaries accounted for the largest portion of their operating expenditures) from routine tasks so that they could provide value added services. Based on this expectation, VLibrary had developed a new staffing procedure that enabled self check-out in their new branches. Staff members who were freed up from check-in/out activities were expected to be assigned to *"operate computer labs and drive up windows, do programming in meeting rooms, lead teen activities, operate homework centers and generally invest more time with the customer during each customer visit" (VD).* However, the actual self check-out rate varied from 11% to 83% among the branches in VLibrary and the

expected reduction in the staff time was not realized. *"I haven't seen the savings [in staff]. I am thinking that barcodes might be a better solution considering the cost [of RFID]" (VB).*

A branch manager in SLibrary also regretted his inability to implement automatic check-in because it required major changes to the physical layout of the library and its software systems. *"There were some unexpected difficulties in the check-in process… I regretted not making it possible to do the check-in at the desks where the patron is returning items" (SB).*

Decision makers in the libraries expected to see improved security of their collections because of the investment in RFID. However, since the system did not work as expected, decision makers experienced regret. *"Our RFID system didn't work as well as we had anticipated. We noticed that RFID tags had been ripped off from books and thrown into trash. Since the trash goes through a back door which didn't have a security gate, we didn't know about the loss of books for quite a while. I wish I had considered that possibility which looks obvious after the fact" (CM).*

Decision makers also experienced regret with some aspects of their decision making process. In both VLibrary and SLibrary, decision makers experienced regret about the processes they had used to select vendors and to evaluate the technology. For example, the director at SLibrary explained his regret with the vendor selection process. *"I wish we could choose a different vendor. The technology and the applications are improving slowly, but we are not at the level we expected to be at. Another major mistake on my part to assume that it was ready"* (SD).

2.4.6 Regulate Experienced Regret and Value, Create or Exercise Real Options

Decision makers in the three libraries that initially invested in RFID took actions to regulate the regret they experienced as a result. These strategies influenced the valuation, creation or exercise

of real options. The strategies are also expressed in the forms of 'action' and 'action tendencies' identified in Table 2.

2.4.6.1 Decrease goal level: Strategic growth options and Stage options

Since the goal of reducing labor costs with the use of self check-out was not fully met, the director at VLibrary redefined his original goal to mitigate this regret. *"I don't think it [RFID] is a failure even though I wish we got the saving on staff [by RFID], [but] I think we are in the transitional period. That is our hope that as we capture a higher percentage of folks using self check, we will see a reduction of the technician positions that we need to fill or to keep" (VD).*

Decreasing the goal level was also used as a strategy to regulate the regret related to the inability to implement inventory control. The perceived criticality of inventory control was changed to "a *nice thing to have rather than critical*" *(SM).* A service manager in VLibrary commented that while this component was important for collections management, it was not critical for his operations: *"It would be great to have it [inventory control] but I am right now working with the assumption that we know what is going out and what is coming in and therefore, what we should have" (VM).* Similarly, *"I had anticipated this technology to fully automate check-in and check-out, but we couldn't do it with CDs and DVDs and with inter-library loans. So we decided it is not necessary to use RFID for all aspects of our operations" (CM).*

The decision makers concluded that the unaccomplished goals were "not necessary" so that they could feel better about their initial decisions. They emphasized that the investments made during early stages provided opportunities for learning from mistakes, and helped them make better decisions during later stages. *"I think the fact that we've implemented this over a long period of time, we've been able to learn from mistakes … we learn as we go along" (VI).*

By decreasing the initial goals, the project outcomes were considered satisfactory. Therefore, the decision makers ignored the failure of some elements and by creating strategic growth options they could continue the investments at a later time.

This strategy also led to creating the stage options in CLibrary. CLibrary had initially planned to have all of their acquisitions tagged with RFID tags by entering into agreements with their suppliers. However, when one of the suppliers did not complete the task within the agreed time frame, it delayed the availability of some critical materials. Therefore, the director of CLibrary decided to decrease the goal level so that some of the materials could be tagged in stages. The director explains this decision: "*I wish we had taken this possibility [of delay] into account. Some important text books were not available at the beginning of the term and this was a serious problem. I didn't want to face this situation again and decided to do the tagging in the library itself in some cases. Some of the collections get tagged before entering the library and others later*" *(CD).*

2.4.6.2 Transfer decision responsibility: Abandon options

An action taken to mitigate experienced regret involved transferring decision responsibility. SLibrary fired the Director of IT largely due to the bad publicity generated by the false alarms at the security gates. *"The fiasco at the security gate when an important patron was stopped in fact created quite a storm. Someone had to take the fall for this. It turned out to be the director of IT because he did not do due diligence while implementing the gates. He was fired mainly as a result of this fiasco" (SM).* Such a dramatic action created a negative work atmosphere in SLibrary.

A senior manager at SLibrary was quick to point out that the development of solutions for some of the problems faced by the library staff were solely the responsibility of the vendor.

Therefore, she required the vendor to be directly involved in resolving the issues when new investments were made. *"We are now asking the vendor to come and install and test the system on site and have them maintain it for a few days. It reduces a lot of stress my staff had to face because the vendor is [now] responsible for fixing the problems" (SM).*

Following this strategy, SLibrary created the abandon option to deal with situations when the investments in some components of the technology did not perform adequately. For example, when security gates were installed in the new wing, the library retained the option to abandon the RFID enabled gates and bring back traditional security gates, explains a director. "*I don't want to face the possibility of getting blamed if the gates fail again. I don't want to wonder why I didn't plan for a backup" (SD).*

When new software components were delivered, the vendor had to ensure that the components were compatible with the current version of the ILS that was in use. *"I made it a requirement that they [the vendor] will have to stop implementation [of new software] if we identified any incompatibilities"*(SM). This provided the decision maker the flexibility to abandon the investment with minimal expenditure if the technology did not work as expected. Indeed, this option was exercised later by the decision maker when a major software component failed to meet the requirement

2.4.6.3 Undo or reverse decision: Switch options

Since CLibrary was being set up in a new institution, it had to rely on inter-library loans when its collections were still being built up. Most of the libraries from which books were being borrowed used only barcode technology at that time. However, as the result of the decision to go for a full-fledged implementation of the RFID technology, CLibrary did not invest at all in barcode scanners and related technology. The director regretted making this decision and therefore had to

bring back the capability to scan barcodes for the collections being borrowed through inter-library loans. Thus, he created a switch option. "*I wish I had carefully evaluated the value of having some [barcode] scanners. It would have been easier to have installed this technology at the beginning itself. Now that we need this for the interlibrary loans, I decided to invest in this [technology] also*" *(CD).*

2.4.6.4 Improve decision outcome: Strategic growth options

To regulate experienced regret, the director of VLibrary initiated actions that improved decision outcomes by better harnessing the benefits of their RFID project. VLibrary changed policies and operational procedures so that they were are aligned well with the new technology. *"How do we make that [RFID] work? How do we change the policy? These are not technical decisions; there are policy decisions to get the bang for the RFID buck" (VD). "With the current system we need to take some actions. How do you structure the policies so you don't have too many exception(s) in self check-out?" (VM).* In the beginning, when a customer returned a book, it was not immediately marked as checked-in by the library system, and therefore the customer was unable to borrow new materials. Therefore, VLibrary changed the procedures so that materials returned to the library were marked immediately as checked-in. Following this strategy, decision makers created the strategic growth option to continue investment in RFID. "*That has nothing to do with RFID, that is our policy, our procedure" (VM).*

In summary, the strategies adopted to regulate the experienced regret influenced the valuation, creation or exercise of real options. Table 5 summaries the key concepts of the

Table 5. Summary of Key Concepts with Illustrations

Concepts	Stage Options	Defer Options	Strategic Growth Options	Switch Options	Abandon Options
Environmental Uncertainty	IT uncertainty ✓ Technology novelty and turbulence	IT uncertainty ✓Technology novelty and turbulence ✓Benefit uncertainty	IT uncertainty ✓Technology novelty and turbulence IT project uncertainty ✓Resource uncertainty	IT uncertainty ✓Technology novelty and turbulence	IT uncertainty ✓Technology novelty and turbulence
Anticipate Regret	DM anticipated regret about RFID investment decision because of high technology uncertainty.	DM anticipated regret about RFID investment decision because of technology novelty and high benefit uncertainty.		DM anticipated regret about RFID investment decision because of high technology turbulence.	
Experience Regret			DM experienced regret about RFID investment decision after an initial goal was not reached.		DM experienced regret about RFID investment decision because of the system malfunction.
Regulate Anticipated Regret (AR)	To address AR, DM engaged in 'reach goal incrementally' strategy.	To address AR, DM engaged in 'delay decision' strategy.		To address AR, DM engaged in 'ensure decision reversibility' strategy and kept the barcodes systems.	
Regulate Experienced Regret (ER)			To address ER, DM engaged in 'decrease goal level' strategy. DM ignored the failure of some elements and escalated the project to future investment.		To address ER, DM engaged in 'transfer decision responsibility' strategy and made future problems the vendor's responsibility.
Value, Create or Exercise IT Real options	The regulation strategy led DM to value a stage option highly and created a stage option.	The regulation strategy led DM to value a defer option highly and created a defer option.	The regulation strategy led DM to value a strategic growth option highly and created a strategic growth option.	The regulation strategy led DM to value a switch option highly and created a switch option.	The regulation strategy led DM to value an abandon option highly and created an abandon option.

Note: DM = IT Real Option Decision Maker; ER = Experienced Regret; AR = Anticipated Regret

framework with illustrations on how each real option resulted from strategies used to regulate anticipated and experienced regret.

2.5 Discussion

The findings from our study suggest that regret plays an important role in IT real options decision making. In this section we discuss the implications of our research in the following areas: the link between real options thinking and regret, the role of regret regulation strategies in valuing, creating, and exercising real options, and the functional and dysfunctional impact of those strategies.

2.5.1 The Link between Real Options Thinking and Regret

Literature on real options (e.g., Adner & Levinthal, 2004; Luehrman, 1998; McGrath, 1997, 1999; Trigeorgis, 1996) has largely emphasized the value of flexibility that is provided by real options. For example, when the uncertainty involved in investment decisions increases, creating options to postpone investments and waiting for signals about the outcomes of the investments have been shown to be effective strategies. In contrast to the flexibility provided by options, prior studies also have revealed the value of early commitment in competitive situations (Dixit & Pindyck, 1994; Ghemawat, 1991; Gilbert & Lieberman, 1987; Lieberman, 1987a). Irreversible commitments are aimed at gaining strategic advantages by discouraging rivals from investing. In situations that are both imperfectly competitive and uncertain, the value of flexibility must be traded off against the value of early commitment.

The context of investment in RFID in public libraries is characterized by high uncertainty mainly because of the novelty and turbulence of the technology, and low competition because of the nature of industry. Prior research suggests that in such situations, the flexibility provided by real options is usually preferred over early commitment. However, our data shows both

alignment to as well as differences from this preference. For example, when faced with the high uncertainty involved in RFID implementation in their libraries, SLibrary and VLibrary created *stage options* to implement the technology in phases. However, our study also reveals that early commitment may be preferred over flexibility even in this context as a result of the actions taken to regulate emotions. For example, in CLibrary, the high anticipated regret associated with the loss of the opportunity to invest in an advanced technology led decision makers to commit early to investing in the technology in spite of the high uncertainties involved in the technology. This suggests that regret may play an important role in the pursuit of flexibility or early commitment. Decision makers take actions to mitigate the intense negative emotion and these actions may not align with the rationale evaluation of the alternatives which would have led to the creation of different types of options as observed in prior studies.

2.5.2 Regret Regulation Strategies and Real Options

Prior studies suggest that, under high uncertainty, 'anticipated regret' of decision makers influences the valuation of the defer options and the strategic growth options in IT investment decisions (Lankton and Luft 2008). Our study extends this finding by suggesting that not only anticipated regret but also experienced regret influences real options decision making. Anticipated regret is a function of predicted decision outcomes and it influences the valuation of real options before an IT project starts. Experienced regret is a function of decision outcomes actually realized in an IT project. Our findings show that experienced regret motivates decision makers to take correctives actions and it also influences the subsequent valuation and creation of real options.

Prior research on decision making process indicates that cognitive feedback improves decision makers' performance (Sengupta and Abdel-Hamid 1993; Sengupta and Te'eni 1993).

Fichman et al. (2005), who take a cognition-focused real options approach, suggest that decision makers' capability for evaluating the degree of uncertainty and potential gains or losses plays an important role in the valuation of options (see Table 6). They emphasize rational (or cognitive) capability of real options decision makers.

However, high uncertainty is one of the major challenges in the cognitive valuation of options. In highly uncertain situations, decision makers have difficulty in valuing the expected payoffs and predicting the impact of the evolution of technologies on their investments (e.g., Fichman 2004; Fichman et al. 2005). Our study suggests that regret shapes the decision making process when the cognition-focused real options approach has a limitation due to high uncertainties. Our study provides a nuanced understanding on IT real option decision making, rather than providing competing explanations to the cognition-focused approach.

Salient regret regulation strategies that influence real options thinking are compared with the cognitive factors identified in Table 6. Decision makers with either experienced or anticipated regret become regret averse. They are motivated to minimize their regret and take vigilant actions through regret regulation strategies, which, in turn, lead to the valuation, creation and exercise of specific real options that may not align well with the cognition-focused approach.

For example, a major challenge to the valuation of strategic growth options comes from the high uncertainties associated with net payoffs and longer time frames. Organizations have been observed to create this option so that future investment decisions can be made when the relative value of follow-on investments becomes clearer (Fichman et al. 2005). Our findings suggest that the strategies used to minimize experienced regret about a prior decision influence the creation of this option. This strategy sometimes does not totally align with the cognitive evaluation of the payoffs of the follow-on investments. In some of the focal organizations, decision makers

Table 6. Cognition Focused and Regret Focused Approaches to Value, Create, or Exercise Real Options

Options	Cognition Focused Approach	Regret Focused Approach	
	Major factors	**Experienced Regret Regulation Strategy**	**Anticipated Regret Regulation Strategy**
Stage	✓ Risks due to technical complexity (Benaroch et al. 2006). ✓ Reassessment of costs and benefits (Fichman et al. 2005).	Decrease goal level ✓ A goal in a first stage was failed to achieve. ✓ Experienced regret about RFID investment decision leads decision makers to decrease goal level at a decision in a subsequent stage.	Reach goal incrementally ✓ Under high RFID technology uncertainty ✓ Anticipated regret about investing RFID decision leads decision makers to incrementally investing in RFID.
Abandon	✓ Client acceptance risk, organizational adoption risk, etc (Benaroch et al. 2006). ✓ As actual costs and benefits become clearer (Fichman et al. 2005).	Transfer decision responsibility ✓ System malfunction happened. ✓ Experienced regret about RFID investment decision leads decision makers to the creation of an option to abandon implementation of the software system at the vendor's cost.	
Defer	✓ A project is evaluated as a losing proposition (Fichman et al. 2005). ✓ Immediate forgone cash flows are small (Benaroch et al. 2006).		Delay decision ✓ Under high RFID technology uncertainty ✓ Anticipated regret about investing RFID decision leads the director to emphasizing the potential negative outcomes and focusing on considering the cost of RFID, rather than the benefits. Increase decision quality ✓ Under high project uncertainty ✓ Anticipated regret about ambiguous process leads decision makers to requesting a revised call for proposals.
Strategic Growth	✓ Relative value of follow-on investments becomes clearer. Only investments with positive pay offs are pursued further (Fichman et al. 2005).	Decrease goal level ✓ Initial goal was not reached. ✓ Experienced regret about RFID investment decision leads decision makers to decrease the goal to continue future investment. Improve decision outcome ✓ Initial goal was not reached. ✓ Experienced regret about RFID investment decision leads decision makers to take actions to improve the outcome of RFID system and continue future investment.	Reach goal incrementally ✓ Under high technology uncertainty ✓ Anticipate regret about no RFID investment decision leads decision makers to making an initial baseline investment in technology infrastructure while prospecting potential opportunities of subsequent IT investments.
Switch	✓ An organization switches to an alternative technology when a chosen technology proves less robust (Fichman et al. 2005).	Undo or reverse decision ✓ Technology malfunction happened. ✓ Experienced regret about RFID security gate leads decision makers to switch back to original gate system.	Ensure decision reversibility ✓ Under high technology uncertainty ✓ Anticipate regret about RFID investment decision leads decision makers to keeping the old barcodes system in parallel so that they could revert back to it.

decreased the level of their initial goals about RFID to reduce experienced regret. In VLibrary, for instance, the inventory control feature was redefined as a "nice to have" and noncritical feature. Thus, the emotion they experienced influenced the decision makers in the creation of *strategic growth options*.

Under high uncertainty, anticipated regret about a particular decision plays a role in valuing and creating real options. For instance, prior literature suggests that *switch options* are valuable when either the relative value of switching is more obvious or switching to a rival technology is more profitable (Fichman et al. 2005). Our findings suggest intense emotion such as regret influences the creation of the switch option. Decision makers who have high anticipated regret about IT investment decision because of the potential malfunctioning of the technology and the interruption it may cause to business activities seek to ensure that their investment decision is reversible to reduce their regret. This leads them to the creation of *switch options*.

Our data also shows that regret and cognitive assessment closely intertwine and shape the real options thinking. In exercising *stage options*, decision makers assessed the costs and benefits in each stage and engaged in counterfactual thinking, which in turn triggered experienced regret about the decisions made. To regulate regret, decision makers decreased the goal level in subsequent phases and created *stage options*.

2.5.3 Functional, Dysfunctional Regret Regulation Strategies and Biases

Our results suggest that regret regulation strategies may be either functional or dysfunctional in influencing the valuation, creation, and exercise of real options (see Table 7). Based on prior literature (David et al. 2004; Mikulincer 1998), we define *functional strategies* as adaptive behaviors and *dysfunctional strategies* as maladaptive behaviors adopted by decision makers in order to regulate regret.

Table 7. Functional, Dysfunctional Regret Regulation Strategies and Biases

Influence		Description	Example Regret Regulation Strategy Observed
Functional	Functional Defensive	Taking adaptive actions to minimize regret, thus reducing adverse consequences.	To minimize anticipated regret about RFID investment decision, decision makers chose 'reach goal incrementally.'
	Learning	Learning lessons from negative outcomes and engaging in activities to improve future decision outcomes.	After a failure to implement inventory control wands in the first phase, to minimize anticipated regret about RFID investment decision, decision makers chose 'increase decision quality' and 'increase decision outcome' by following well-established procedures to evaluate new inventory control wands.
Dysfunctional	Dysfunctional Defensive	Taking maladaptive actions to minimize regret, thus increasing adverse consequences.	To minimize experienced regret about security gate installment decision and its failure, decision makers transferred decision responsibility to the director of IT and fired him. This created negative work atmosphere.
Biases	Misprediction	Tendency to overvalue/ undervalue a target event or phenomenon due to anticipation of regret.	Anticipated regret about RFID investment decision due to leaving behind in high technology usage and losing an opportunity to offer innovative services led decision makers to overvaluing the benefits of RFID technology in CLibrary and abandoned the alternative technology without careful evaluation.
	Omission	Tendency to prefer harm caused by omissions over equal or lesser harm caused by acts due to anticipation of regret.	Decision makers had greater anticipated regret about high cost of RFID technology and possible negative outcomes from immature technology without considering the benefits of technology at TLibrary. They created a defer option and had waited until the technology becomes stable. But until today, they have been not utilizing the benefits of advanced technology and thus lost opportunity to offer innovative services.

We classify the regret regulation strategies into defensive strategies and learning strategies based on their focus on emotion or on decision outcome. (1) Defensive strategies focus on reducing discomfort and increasing comfort (Frijda 1986). They can be either functional or dysfunctional. Functional defensive strategies use adaptive actions to minimize regret, thus reducing adverse consequences, while dysfunctional defensive strategies use maladaptive actions to minimize regret, thus increasing adverse consequences. (2) Learning strategies focus on

learning lessons from negative outcomes to improve future decision outcomes. Therefore, we classify learning as a functional strategy. In addition to dysfunctional defensive strategies, our study identifies two types of bias influencing regret regulation strategies: misprediction and omission (see Table 7). We discuss below the implications of these strategies and the biases.

Functional regret regulation strategies: Although regret is a negative emotion and people try to avoid it, regret regulation strategies offer some functional advantages in real options decision. Functional defensive behaviors that reduce discomfort and thus reduce adverse consequences (Frijda 1986) were observed in our study. Experienced regret regulation strategies such as 'decrease goal level' and 'undo or reverse decision' and anticipated regret regulation strategies such as 'reach goal incrementally' and 'ensure decision reversibility' are examples of functional defensive strategies.

Although all regret regulation strategies intrinsically aim at reducing regret and discomfort, some (such as 'increase decision quality' and 'improve decision outcome') offer the advantage of learning and improvement. A prior study (Inman 2007) suggests that decision makers who experience regret decouple their feeling of self-blame from the opportunity to learn and thus make a better decision in the future. Our findings additionally show that the functional advantage occurs at regulating experienced or anticipated regret about real options decision procedures and outcomes. For example, decision makers engage in more vigilant actions to improve their decision procedures. They use well established evaluation and testing procedures and hence try to collect all the relevant information to improve the quality of decisions and thereby decision outcomes.

Dysfunctional regret regulation strategies: Some dysfunctional regret regulation strategies were also observed in our study. First, to minimize regret and reduce discomfort, decision makers

were involved in dysfunctional defensive behaviors (such as 'transfer decision responsibility' and 'delay decision') that resulted in increasing adverse consequences. For instance, decision makers in TLibrary delayed their decision due to intense anticipated regret. This behavior may cause the decision makers to create *defer options* inappropriately. Prior studies on real options identify this phenomenon as one of the pitfalls of *defer options* (Fichman et al. 2005). Our study offers an explanation on why this dysfunctional behavior occurs. While anticipating regret, decision makers tend to focus only on regulating their emotions and as a result, their cognitive assessment is hindered. They become regret aversive and in turn decision aversive. Delay decision strategy allays decision makers' regret in the short term. But in the long run, it can raise higher levels of regret about losing the opportunity to use an advanced technology at the appropriate time.

Biases influencing regret regulation strategies: Prior studies on real options thinking suggest that decision makers are prone to engage in cognitive biases such as bounded rationality bias and anti-failure bias in the valuation and creation of real options (e.g., Tiwana et al. 2006; Tiwana et al. 2007). These studies identify cognitive biases and explain the reasons for their occurrence at the cognitive level. In contrast, our study contributes to the real options literature by identifying potential biases caused by regret and explains the reasons for their occurrence at the emotional level. Our study suggests that in some instances, decision makers use regret regulation strategies that are biased towards action, such as 'misprediction' and 'omission.' This, in turn, leads to the valuation, creation, and/or exercising of real options that produce negative consequences.

Gilbert et al. (2004a) suggest that the misprediction occurs when the anticipation of regret leads decision makers to overvalue or undervalue a target event or phenomenon (e.g., overpay for technology products, overvalue an ability). In the adoption of RFID technology, Otondo et al.

(2009) point out that overvaluing RFID's potential might compromise the decision makers' capability to arrive at an appropriate decision. Tiwana et al.'s study (2007) identifies 'bounded rationality bias' in satisfying information search practices. Decision makers terminate "information search without further considering a broader realm of available information to form a judgment…satisfiers are ready to act as soon as they have enough information to satisfy their self-imposed informational requirements" (Tiwana et al. 2007, p. 161). Our findings suggest that anticipated or experienced regret influence the identification of the satisfying point. For example, decision makers consumed by high anticipated regret about being left behind in high technology use tend to overvalue the capability of the technology and terminate their information search without considering all available information. Thus, they are vulnerable to the misprediction bias. Furthermore, Tiwana et al. (2006) suggest that decision makers tend to undervalue specific types of real options (e.g., *abandon option* and *stage option*) because they misperceive the potential value of such options. Our findings suggest that such misperception occurs because of high anticipated regret about the negative consequences from the most adverse circumstances. Here, the experience of high regret blinds decision makers from properly perceiving the value of available options.

Prior real options literature (Fichman et al. 2005; Tiwana et al. 2006) also suggests that decision makers are susceptible to anti-failure bias, in which decision makers perceive project abandonment as a failure and find it difficult to terminate a project. Our findings provide additional insights on this phenomenon by investigating it at the emotional level. Regret theorists suggest that to regulate regret, people tend to involve in omission bias that results from "a greater willingness to accept harms from omission, the default, than harms from action" (Baron and Ritov 2004, p. 75). Our study suggests that the decision makers' difficulty in terminating a

project may result from high anticipated regret from potential negative consequences. In the case of TLibrary, the high anticipated regret about the appropriateness of the RFID technology for their current situation led decision makers to prefer the continued use of the old barcode system and accepting the inefficiencies associated with it. To avoid regret, the decision makers engage in dysfunctional behaviors, in which they prefer to accept current losses resulting from the continued use of a technology, than the loss that may be incurred by terminating the use of this technology.

2.6 Conclusion

2.6.1 Implications for Research

Prior studies have established the significance of regret in decision making in a variety of contexts (e.g., Inman 2007; Zeelenberg and Pieters 2007). However, there has been limited research on understanding how regret influences the IT real options decision making. We address this limitation by developing a framework that explains the linkages among environmental uncertainties, regret of decision makers, regret regulating strategies, and real options decisions. Further, much of the literature on regret has used laboratory experiments to study the antecedents of regret (e.g., Hung et al. 2007; McConnell et al. 2000; Pieters and Zeelenberg 2005) or its effects on an intention/behavior (Larrick and Boles 1995; Reb 2008; Simonson 1992b; Zeelenberg and Beattie 1997). In contrast, our framework which is based on a study of an organizational decision making environment highlights how these elements influence each other, and over time. Below, we elaborate on these contributions.

A primary assumption in the literature on real options thinking is that the valuation of real options is based on a rational evaluation of costs and benefits (Fichman et al. 2005; Ondrus et al. 2005). Our study suggests that emotion also plays a role in real options decision making. The

emotional perspective helps explain how decision makers value real options and how they create and exercise them (Lankton and Luft 2008). This perspective allows us to explore human behaviors at a psychological level and provides us with more fundamental understanding of real options thinking. Thus, our research provides an initial step in the development of the much needed emotional perspective for understanding IT real options decision making and offers opportunities for complementing prior literature on real options thinking with the decision maker's emotion.

While much of the prior literature on real options thinking has focused on the creation of real options at the beginning of an IT project, our framework helps understand how real options are created at various phases of a project as a result of strategies used to regulate experienced regret. Thus, it provides a more comprehensive understanding of how real options are created in an IT project as the project unfolds.

2.6.2 Implications for Practice

Our study provides implications for IT real options decision makers.

Recognize regret and its role on decision making: Decision makers should understand that people are often reluctant to express their negative emotions such as regret and as a result, they fail to recognize the impact of regret on their decision making process. Regret is often expressed indirectly in terms of a decision maker experiencing a sinking feeling, having thoughts about a lost opportunity, and expressing motivational goals such as looking for a second chance. Decision makers should learn to recognize the presence of regret and be sensitive to the impact of regret on their decision processing process.

Choose appropriate regret regulation strategy: Decision makers should understand that some regret regulation strategies are functional in that they improve the quality of the decision process

as well as outcomes, while others are dysfunctional in that they lead to adverse consequences or biased decisions. Decision makers should seek to maximize the use of functional strategies and avoid the use of dysfunctional strategies to regulate regret.

Create appropriate real options: Decision makers should understand how regret regulation strategies influence the valuation, creation, and exercise of IT real options. Since the use of 'learning strategies' may significantly improve the quality of their future decisions by taking more vigilant actions and creating appropriate real options, decision makers should actively seek to use such strategies.

2.6.3 Limitations and Future Work

Our findings may be particularistic to the four organizations studied. Generalizability of the findings is undermined by the particular context of the study such as organizational culture, individual characteristics, and the nature of RFID technology. This suggests the need for further empirical studies to examine the validity of the findings in different contexts. While we employed a research design commonly used in the field of psychology for studying emotion retrospectively, it is also conceivable that our approach might create recall bias in the informants. However, this risk is mitigated by including multiple respondents from each organization and the availability of public documents about the decision made which provide the ability to triangulate the findings.

Our study offers the necessary groundwork for further quantitative research operationalizing the elements in our framework and examining the relationships among them. While the study focused on the role of regret in the decisions made by individual decision makers, investigations of factors such as organizational culture, norms, influence of group members on individuals that influence emotions may offer further nuanced insights into the phenomenon.

Appendix 2A: Components of RFID Technology in Libraries

Check-in: Automatic check-in offers RFID-enabled book drops (in-wall, or standalone outdoor/indoor book returns). The software automatically checks in returned items in the library's database and reactivates the security tag with options of printing a receipt and/or hold notices. Semi-automated check-in by library staff is also possible.

Self Check-out: A self-check workstation allows patrons to checkout without the need for the involvement of staff.

Security Gate: Detection of any unchecked library items leaving the premises and alarm systems to alert staff to unchecked items being carried out of the premises.

Material Sorting/handling: A multiple-bin sorter provides advanced customized sorting of materials into a number of carts/bins, each dedicated to a specific location within the library. It saves physical labor and reduces staff injuries.

Automated Conveyor: With an automated conveyor system, items are sent to their appropriate locations.

Inventory Control: The collection can be scanned for inventory taking or search for specific items that are missing, lost, on hold, transit, claimed returned, and mis-shelved. These functions can be carried more efficiently and accurately without the need to physically pull items from shelves.

Appendix 2B: Study Sites

VLibrary: It supports the educational and leisure needs of citizens with a system of eight area libraries, a central library, a bookmobile, a public law library, a municipal reference library and special services for the blind and visually handicapped. It has a collection of more than 1 million items which includes books, audio books, music CDs, video tapes, DVDs, books in large type, magazines and newspapers. The library subscribes to numerous online reference sources, ebooks and audiobook services. The library has been building new branches and renovating buildings in recent years. Initially, the RFID project was a part of the capital expenditure for new library branches. Later VLibrary adopted RFID in almost all its branches.

SLibrary: Nearly 6.5 million visitors check out approximately 7 million items each year. It subscribes to over 150 online reference databases and holds over 1 million items in its collection. SLibrary also viewed the opening of new branches as an opportunity to invest in RFID technology. The RFID project was initially implemented in a new branch and then rolled out to the entire system.

TLibrary: It houses over 2.5 million books, periodicals and nearly 30,000 e-journals and publications and 1800 electronic government documents. It supports over 20 million virtual visits, over 2.6 million search and nearly 1.2 million full-text articles retrieved from its electronic databases. Also, over 2 million items are accessed from its digital collections.

CLibrary: It supports the students and faculty of a four year university. It houses about 65000 books and periodicals and subscriptions to extensive electronic resources in the form of databases. Further, the relatively smaller size of this academic library also influenced the decision to invest in RFID technology. It adopted most of the available components of the RFID technology when the new library building was inaugurated.

Chapter 3

Violations of Health Information Privacy: The Role of Attributions, Seriousness of Wrongdoing, and Anticipated Regret in Whistleblowing

3.1 Introduction

With the passage of the American Recovery and Reinvestment Act of 2009, which included $20 billion to modernize health information technology systems, the digitization of patients' medical records has accelerated in the United States. This growth, however, brings increased concerns regarding protection of sensitive health information, which can now be more readily shared. According to Angst and Agarwal (2009, p. 348), there is "substantial and growing evidence that privacy and security of health information is a matter of paramount importance to individuals." This is consistent with the fact that people are more sensitive about their personal health information than other types of information about their lives (Smith et al. 2011). A survey conducted by the California HealthCare Foundation found that 67 percent respondents felt "somewhat" or "very concerned" about health information privacy (Bishop et al. 2005).

While the Health Insurance Portability and Accountability Act of 1996 (HIPAA) was enacted, in part, to protect patients' health information privacy, there have been several instances in which violations of health information privacy have occurred.

> In 2007, a front desk office coordinator at The Cleveland Clinic was convicted for selling Medicare and other demographic information about approximately 1,130 patients leading to $7 million in fraudulent Medicare claims (Wood 2008). [Example A]

> In 2012, Blue Cross Blue Shield of Tennessee agreed to pay $1.5 million to settle potential violations after 57 unencrypted computer hard drives containing sensitive medical information on more than 1 million patients had been stolen (Mueller 2012). [Example B]
>
> In 2013, a jury awarded a woman $1.44 million after finding that a Walgreens pharmacist had violated her privacy by looking up and sharing the woman's prescription history (Evans 2013). [Example C]
>
> In 2013, the Shasta Regional Medical Center ("SRMC") of California paid a sum of $275,000 for intentionally disclosing protected health information to the media. The U.S. Department of Health and Human Services Office of Civil Rights Director Leon Rodriguez stated, "When senior level executives intentionally and repeatedly violate HIPAA by disclosing identifiable patient information, OCR will respond quickly and decisively to stop such behavior" (Sylvia and Freedman 2013). [Example D]

Based on the above examples, violations of health information privacy can result from intentional (example A, C, and D) or unintentional (example B) actions. Further, as OCR Director Rodriguez suggests, such violations can be attributed either to stable causes (i.e., behaviors that are not likely to change as evidenced by repeated violations) or unstable (i.e., behaviors that are likely to change) causes.

Violations of health information privacy such as the ones mentioned above are likely to become more common with the growing digitization of health records and the concomitant sharing of sensitive health information within the health care system (Angst and Agarwal 2009). In the past, patients medical records were stored in physical form, there was less sharing of health information, and therefore less potential for accidental leakage or intentionally inappropriate use of sensitive information. Based on the above examples, it is clear that legislation such as HIPAA, no matter how well intentioned, cannot prevent inappropriate use of sensitive health information. Therefore, from a patient (or consumer) protection perspective, it is important to understand how such violations can be made visible to decision makers with the authority to take appropriate corrective action. When organizational wrongdoing occurs,

whistleblowing by an insider remains perhaps the most effective way of bringing such violations to light.

The Health Information Technology for Economic and Clinical Health Act (HITECH) of 2009 is likely to bring an increase in whistleblowing cases because it contains provisions for the sharing of civil monetary penalties with individuals harmed by an improper breach of protected health information (Liles 2012). Thus, if a patient's medical records are inappropriately accessed or used, the harmed patient may be eligible to receive a portion of the penalties collected by the government.

While there has been prior research on whistleblowing in a variety of different contexts, the question of how violations of health information privacy affect whistleblowing intentions remains uninvestigated. This represents an important theoretical gap that we seek to address with the present study. One problem that can arise in this context is when organizations that have access to protected health information (e.g., electronic medical records) decide to use that information in ways that violate health information privacy (e.g., using protected health information for marketing purposes). When such violations occur, it is of theoretical importance to understand what motivates or inhibits individuals from engaging in whistleblowing. In this research study, we draw on attribution theory (e.g., Weiner 1985; Weiner 1992) and the concept of anticipated regret (e.g., Inman 2007; Simonson 1992a; Zeelenberg and Pieters 2007) to understand whistleblowing intentions in the context of health information privacy violations. Specifically, we address the following research questions:

(1) To what extent do certain attributions (i.e., intentionality and stability) and perceived seriousness of wrongdoing affect anticipated regret about remaining silent?
(2) To what extent does anticipated regret about remaining silent influence whistleblowing intentions?

In the sections that follow, we briefly review relevant literature, introduce our research model and hypotheses, describe our research methodology, and present our analysis and results. We conclude with discussion and implications for research and practice.

3.2 Background

In this section, we review relevant aspects of attribution theory and anticipated regret that we draw upon in our theorizing.

3.2.1 Attributional Theory

The basic premise of attribution theory is that people seek to know why particular events have occurred and as they engage in this sensemaking process, they make certain causal attributions depending on how they construe or evaluate the events. The theory has been extensively used to examine the causal attributions that people make, and the consequences of these causal attributions (e.g., Heider 1958; Kelley 1973; Weiner 1980). According to the theory, when individuals make causal attributions, this can evoke specific emotional responses, which in turn, influence behavior (Weiner 1985; Weiner 1986).

Attribution theory identifies a number of causal dimensions including *stability* and *intentionality* that can drive emotional responses. Stability refers to "the degree to which the cause is anticipated to change over time. Stable causes do not change, whereas unstable causes do" (Martinko 1995, p. 9-10). Intentionality refers to the extent one perceives that the cause for an outcome occurred purposively (i.e., intentionally) or not (i.e., unintentionally) (Weiner 1985). Since our dependent variable of interest is whistleblowing intentions, we focus on these two causal dimensions because they are both relevant to the assignment of responsibility for acts of wrongdoing (Weiner 1985). While attributions can lead to a variety of emotional responses, in

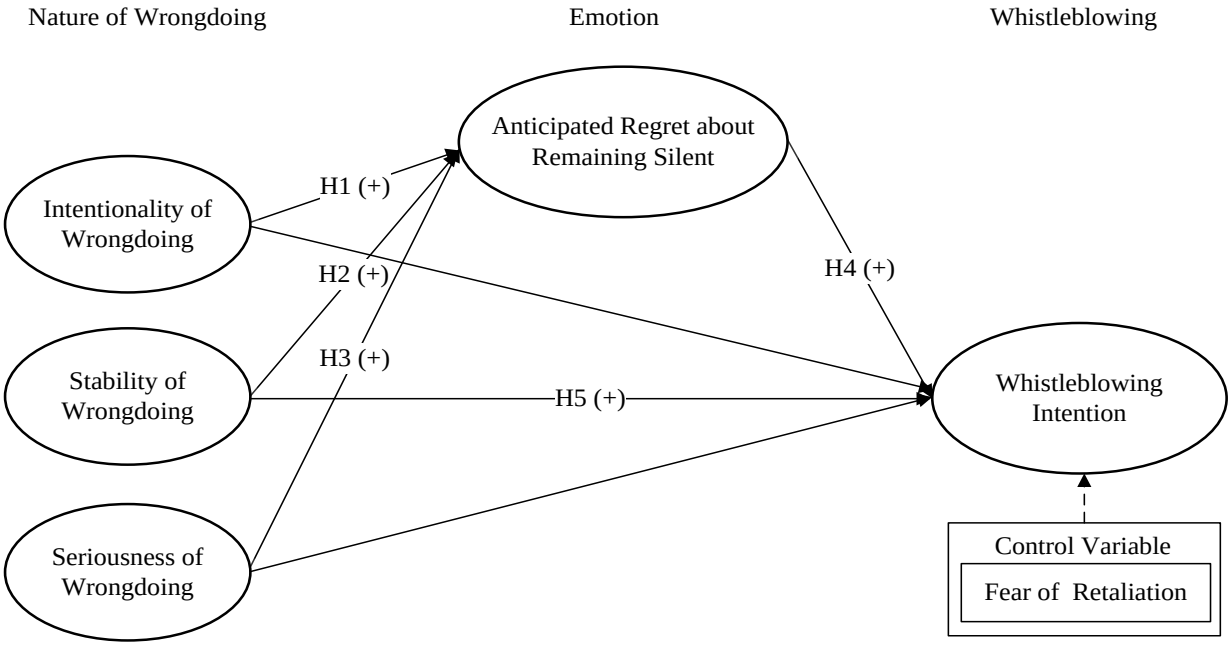
this study, we focus on anticipated regret because it has been suggested that it can influence whistleblowing intentions (Edwards et al. 2009), but this has not be empirically tested.

3.2.2 Anticipated Regret

Anticipated regret is a comparison-based emotion (Zeelenberg and Pieters 2007). When decision makers realize that the current situation is uncertain and a decision is important, they anticipate future regret (Zeelenberg and Pieters 2007). Also "when the most preferred alternative is not necessarily superior to another alternative" (Janis and Mann 1977a, p. 223), they experience anticipated regret. Anticipated regret makes decision makers consider future anticipatory outcomes, and because people are regret averse they may choose a regret avoiding alternative (e.g., Reb 2008; Wong and Kwong 2007; Zeelenberg and Pieters 2007).

Edwards, Ashkanasy, and Gardner (2009) propose a conceptual framework in which they suggest that whistleblowing decisions can be affected by basic emotions such as fear as well as anticipated emotions such as anticipated regret. In a laboratory experiment, Fredin (2008; 2011) examined various predictors of regret including moral intensity of the situation, type of wrongdoing, and salience of regret associated with either whistleblowing action or inaction. Subjects were presented with a hypothetical scenario in which a person in the scenario had to decide whether or not to engage in whistleblowing. For the salience of regret manipulation, subjects were cued to anticipate either how much regret the individual in the scenario would feel if they took action (i.e., engaged in whistleblowing) or not (i.e., chose to remain silent). Fredin found that individuals made greater regret predictions in situations involving high moral intensity and when they were cued to consider possible regret effects associated with remaining silent. While Fredin's (Fredin 2011, p. 423) study suggests that "individuals will recognize the emotional costs that could come with a decision to sit back and do nothing about a wrongdoing

Figure 1. Research model



situation," it does not provide an empirical test of the relationship between anticipated regret about remaining silent and an individual's whistleblowing intentions.

3.3 Research Model and Hypotheses

Drawing on attribution theory and anticipated regret, we developed the research model and hypotheses shown in Figure 1 and discussed in detail below. As indicated in Figure 1, our hypotheses map to only a subset of the paths in the model. This is because two of the paths (intentionality of wrongdoing → whistleblowing intention, and seriousness of wrongdoing → whistleblowing intention) have already been established in prior research. Specifically Gundlach et al. (2008) showed that perceived intentionality of the wrongdoing has a positive influence on whistleblowing intentions. Furthermore, prior studies have provided strong evidence that seriousness of wrongdoing has a positive impact on the whistleblowing intentions (e.g. Miceli and Near 1985; Miceli and Near 1992; Miethe 1999).

3.3.1 Nature of Wrongdoing to Emotion of Anticipated Regret

We theorize that the nature of the wrongdoing (i.e., intentionality of wrongdoing, stability of wrongdoing, and seriousness of wrongdoing) influences anticipated regret about remaining silent. When organizations act intentionally to perform "a morally blameworthy act" (Hamilton and Sanders 1999, p. 222), they may visit serious harm to customers and society (Miceli et al. 2008). When potential whistleblowers realize that an organization intentionally engages in wrongdoing, this can elicit strong emotion (Weiner 1992). In empirical studies, Betancourt and Blair (1992) found a positive relationship between intentionality of a violent action and anger and empathetic emotions. Gundlach, Martinko, and Douglas (2008) also reported a positive relationship between intentionality and anger. However, the relationship between intentionality of wrongdoing and anticipated regret about remaining silent has not been examined in prior empirical studies.

When potential whistleblowers perceive intentionality associated with organizational wrongdoing, they can, in theory, experience greater anticipated regret about remaining silent (Edwards et al. 2009), although this has yet to be shown empirically. Intentionality of wrongdoing may give rise to anticipated regret about remaining silent for two reasons. First, when the decision is perceived to be an important one due to the intentionality that is present, individuals are more apt to experience anticipated regret about remaining silent (e.g., Reb 2008; Zeelenberg and Pieters 2007). Second, the presence of intentionality can make individuals question their initially preferred alternative of remaining silent, such that they are apt to experience anticipated regret. Specifically, potential whistleblowers who perceive organizational wrongdoing as intentional may begin to wonder whether their decision to remain silent will lead to a situation in which harm will come to individuals due to their unwillingness to take a stand. On the basis of the above arguments, we state the following hypothesis:

H1: *Intentionality associated with an organization's wrongdoing will be positively related to anticipated regret about remaining silent.*

In addition to intentionality of wrongdoing, we theorize that stability of wrongdoing can also trigger anticipated regret about remaining silent. The relationship between causal stability and expectancy has been supported by attribution theorists (e.g., Folkes 1984; Weiner 1992). The basic premise is that if conditions are expected to remain the same, then the current outcomes can be expected to occur again. Weiner (1985) points out that stability of a cause can not only influence expectancy, but can also evoke emotional responses.

In the context of whistleblowing, it has been theorized that when employees perceive organizational wrongdoing as resulting from stable (as opposed to unstable) causes, they are more likely to experience emotional responses such as anger, resentment, and fear (Gundlach et al. 2003). In an empirical paper, Gundlach, Martinko, and Douglas (2003) found a positive relationship between stability and anger. However, the relationship between stability and other emotions such as anticipated regret about remaining silent has not been tested. We theorize that stability of wrongdoing may give rise to anticipated regret about remaining silent for two reasons. First, when the decision is perceived to be an important one due to the stability of wrongdoing and the accompanying threat that such wrongdoing will recur, individuals are more apt to experience anticipated regret about remaining silent. Second, the presence of stability can make individuals question their initially preferred alternative of remaining silent, such that they are apt to experience anticipated regret. Specifically, potential whistleblowers who perceive organizational wrongdoing as stable may begin to wonder whether their decision to remain silent will lead to a situation in which harm will come to individuals due to their unwillingness to take a stand. On the basis of the above arguments, we state the following hypothesis:

H2: *Stability associated with an organization's wrongdoing will be positively related to anticipated regret about remaining silent.*

Finally, we theorize that seriousness of wrongdoing also influences anticipated regret about remaining silent. Seriousness of wrongdoing refers to the extent to which a particular wrongful activity may bring harm by resulting in substantial consequences to those who are affected (Gundlach 2003; Miceli and Near 1985; Miceli and Near 1992). Prior studies have shown that serious wrongdoing is more likely to cause potential whistleblowers to perceive that the wrongdoing needs to be reported (Lowry et al. 2013) and to feel some personal responsibility to report the wrongdoing (Lowry et al. 2013; Park and Keil 2009). Observing serious wrongdoing is also likely to elicit strong emotional responses (Edwards et al. 2009). We argue that seriousness of wrongdoing affects anticipated regret about remaining silent for two reasons. First, when wrongdoing is perceived to be serious, individuals will attach greater importance to their decision of whether or not to engage in whistleblowing (Lowry et al. 2013). For this reason, individuals are more apt to experience anticipated regret about remaining silent. Second, when the wrongdoing is perceived to be serious, this can make individuals question their initially preferred alternative of remaining silent, such that they are apt to experience anticipated regret. Specifically, potential whistleblowers who perceive serious wrongdoing to have occurred will wonder whether remaining silent will bring harm to others. On the basis of the above arguments, we state the following hypothesis:

H3: *Perceived seriousness of wrongdoing will be positively related to anticipated regret about remaining silent.*

3.3.2 Emotion of Anticipated Regret to Whistleblowing Intention

Prior research has shown that people are regret aversive (i.e., they are motivated to avoid or minimize regret). Thus, individuals will experience anticipated regret as they weigh various alternative courses of action, and will tend to choose an alternative that minimizes regret (Reb 2008). Potential whistleblowers must weigh blowing the whistle against the alternative of remaining silent and anticipated regret may influence how they weigh these alternatives. Specifically, the anticipated regret associated with remaining silent may make individuals more inclined to engage in whistleblowing. This line of reasoning is consistent with conceptual arguments made by Edwards, Ashkanasy, and Gardner (2009) regarding the relationship between anticipated regret and the whistleblowing decision. In particular, they argue that when potential whistleblowers experience strong anticipated regret about remaining silent, there is a high likelihood that they will blow the whistle. Nevertheless, the relationship between anticipated regret about remaining silent and whistleblowing intentions has not been investigated empirically. In this study, we address this gap by proposing and testing the following hypothesis:

> **H4:** *Anticipated regret about remaining silent will be positively related to whistleblowing intention.*

3.3.3 Stability of Wrongdoing to Whistleblowing Intention

While prior work (Gundlach 2003) examines the impact of the stability of wrongdoing on judgments of responsibility and the emotion of anger, the direct effect of stability of wrongdoing on whistleblowing intention has not, to our knowledge, been previously tested. Martinko and Zellars (1998) suggest that stable attributions are likely to influence behavior intentions. Building on this work, Gundlach, Douglas, and Martinko (2003, p. 111) theorize that "when organizational members attribute wrongdoing acts to stable causes, they will be more motivated

to change the behavior of wrongdoers by blowing the whistle." We seek to test this empirically by investigating the relationship between stability of wrongdoing and whistleblowing intention. We therefore hypothesize:

> **H5:** *Stability associated with an organization's wrongdoing will be positively related to whistleblowing intention.*

3.3.4 Fear of Retaliation as a Control Variable

Fear is a powerful emotion that can result in risk avoidance (Lerner and Keltner 2001; Ohman 1993). In the context of whistleblowing decision, prior research has shown that there is a negative relationship between fear of retaliation and whistleblowing behavior. Near and Miceli (1986), for example, consider retaliation to be a significant factor in shaping whistleblowing intentions, acknowledging that there is often a significant power relationship between management (i.e., superiors) and potential whistleblowers (i.e., subordinates). Based on a large scale survey of managers, Keenan (1990) found a negative relationship between fear of retaliation and perceptions regarding the adequacy of a company's encouragement for whistleblowing. This suggests that fear of retaliation may create a climate of silence in an organization (Jain et al. 2011), thereby reducing employees' willingness to engage in whistleblowing. Based on a qualitative study involving 40 interviews with employees across a wide array of industries, Milliken, Morrison, and Hewlin (2003) reported that fear of retaliation is one of the reasons why employees do not speak up against wrongdoing in the workplace. For these reasons, we include fear of retaliation as a control variable in our study.

3.4 Research Methodology

Whistleblowing is a low-base rate behavior that is not easily studied in organizational contexts. Therefore, a laboratory experiment was selected as the methodology of choice for this study. By

examining the phenomenon in an experimental setting, we were able to achieve high internal validity. While we used student subjects for our experiment, our goal was to generalize to theory and not to a particular population (Compeau et al. 2012). Experiments have been widely used in the study of whistleblowing (e.g., Gundlach et al. 2008; Smith et al. 2001). In this study, we conducted a 2x2 factorial design experiment, in which intentionality of wrongdoing and stability of wrongdoing were manipulated independently, allowing us to study the effect of these variables on whistleblowing intentions.

3.4.1 Scenario and Procedure

Subjects were told that the experiment was about business decision-making, that participation was voluntary, and that their responses would remain anonymous. After completing an informed consent form, subjects were asked to read a short scenario (shown in APPENDIX 3A) involving a pharmaceutical company that is illegally mining the electronic health records of its customers, in violation of the Health Insurance Portability and Accountability Act (HIPAA). Subjects were asked to play the role of an employee who has observed the company's actions and must decide whether or not to engage in whistleblowing.

Subjects were randomly assigned to one of the four treatment conditions in which the level of stability of wrongdoing was portrayed as being either high or low and the level of intentionality of wrongdoing was portrayed as being either high or low. In the high-intentionality condition, subjects were informed that the management of their company is aware of the violation of HIPAA, but is intentionally mining the health records for marketing purposes. In the low-intentionality condition, subjects were informed that the management is new to the company and is unaware that the mining of health records is a violation of HIPAA. Similarly, in the high-stability of wrongdoing condition, subjects were informed that the company has been repeatedly

engaged in wrongdoing. In the low-stability of wrongdoing condition, subjects were told that the violation of HIPAA has occurred for the first time.

After reading the scenario, subjects responded to a set of questions that included manipulation checks as well as measures associated with seriousness of wrongdoing, anticipated regret about remaining silent, whistleblowing intention, and fear of retaliation (as a control variable).

3.4.2 Subjects

Data were gathered from 143 business school students enrolled in information systems courses at a large urban university in the southeastern United States. Seven subjects were dropped from the study either because they failed one or more manipulation checks (4 subjects) or because they were outliers (3 subjects), leaving us with 136 usable responses. The mean age of these subjects was 24 years and the mean work experience was 4 years. Sixty-five percent of the subjects were male and thirty-five percent were female.

While the use of student subjects in research on decision-making often raises concerns about external validity (e.g., Peterson 2001; Sears 1986), our goal was not to generalize to a particular population, but rather to theory. Thus, we argue that use of student subjects in our context is appropriate. Moreover, since our subjects had an average of four years of work experience and had also completed coursework that incorporated conceptual knowledge about ethics and business decision-making, we contend that they had the requisite knowledge to understand whistleblowing situations.

3.4.3 Constructs and Measures

APPENDIX 3B provides a list of our constructs, along with measurement items and informing sources. All of our construct measures were adapted from existing measures and including

multiple measurement items with the exception of anticipated regret about remaining silent, which was assessed using single item measure. The anticipated regret measure was adapted from Wong and Kwong (2007) and is consistent with the measure used by Connolly et al. (1997) and Zeelenberg et al. (1998b). The anticipated regret measure explicitly asks subjects to imagine a possible anticipated negative outcome (Simonson 1992a; Wong and Kwong 2007).

Seriousness of wrongdoing was assessed using two indicators that were adapted from Miceli and Near (1985; 1992) and Gundlach (2003). The whistleblowing intention, which was our dependent variable of interest, was also assessed using two indicators that were adapted from Miceli and Near (1984; 1985) and Gundlach (2003). Our control variable, fear of retaliation, was assessed using three measurement items that were adapted from Keenan (1990).

3.5 Analysis and Results

3.5.1 Manipulation Checks

We conducted manipulation checks to examine whether our intentionality of wrongdoing and stability of wrongdoing manipulations were working as expected. The manipulation check for intentionality of wrongdoing asked subjects to indicate whether they perceived the company's HIPAA violation to be intentional (1 = strongly disagree (i.e., low level of intentionality); 7 = strongly agree (i.e., high level of intentionality)). The manipulation check for stability of wrongdoing asked subjects to indicate whether they perceived that the company's illegal mining of health records was part of an ongoing pattern of behavior (1 = strongly disagree (i.e., low level of stability); 7 = strongly agree (i.e., high level of stability)). In a one-way ANOVA, the mean difference between the low level of intentionality of wrongdoing (M = 3.14, SD = 1.83) and the high level of intentionality of wrongdoing (M = 6.00, SD = 1.48) was statistically significant and in the expected direction, $F(1,136) = 102.11$, $p < .001$, $\eta^2_p = .43$. In a separate one-way ANOVA,

the mean difference between the low level of stability of wrongdoing (M = 3.37, SD = 2.08) and the high level of stability of wrongdoing (M = 5.57, SD = 1.41) was statistically significant and in the expected direction, $F(1,136) = 53.36$, $p < .001$, $\eta^2_p = .28$. The ANOVA results indicate that the manipulations were effective.

3.5.2 PLS Analyses

We analyzed the data with partial least squares (PLS) using SmartPLS 2.0 (Ringle et al. 2005). PLS is a structural equation modeling technique that uses a component-based approach to estimation. Many prior studies on whistleblowing have adopted PLS analysis (e.g., Keil et al. 2004; Smith et al. 2001; Thompson et al. 2007).

3.5.2.1 Measurement Model Assessment

All of our constructs were modeled reflectively and our measurement model assessment involved an examination of convergent and discriminant validity.

Convergent Validity. To evaluate convergent validity, we began by examining standardized loadings. When the standardized loadings are greater than 0.707 this indicates that the shared variance between each item and its associated construct exceed the error variance (Chin 1998). As shown in Table 1, all the loadings were 0.846 or higher, thus exceeding this threshold. Based on these results, all of the indicators were retained for subsequent analysis.

Next, we evaluated the internal consistency for each block of measures by examining Cronbach's alpha, composite reliability, and average variance extracted (AVE). Values for Cronbach's alpha and composite reliability that exceed 0.70 provide adequate evidence of reliability (Bearden et al. 1993; Yi and Davis 2003). As shown in Table 1, all of the constructs in the measurement model exhibited

Cronbach's alpha of 0.75 or higher, and composite reliability of 0.88 or higher. Fornell and

Table 1. Item loadings and construct reliability

Construct	Item	Standardized Loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Seriousness of Wrongdoing	Swrong1 Swrong2	0.921 0.924	0.826	0.920	0.852
Whistleblowing Intention	Dc1 Dc2	0.851 0.928	0.746	0.884	0.793
Fear of Retaliation	Fear1 Fear2 Fear3	0.957 0.942 0.846	0.909	0.940	0.839

Larcker (1981) suggest examining the average variance extracted (AVE) as another indicator of construct validity. AVE measures the variance that a latent construct captures from its indicators relative to the variance due to measurement error (Chin 1998). The accepted threshold for AVE is 0.5 or higher, indicating that 50% or more variance of the indicators is accounted for (Chin 1998). As seen in Table 1, all AVEs are above this threshold. Based on the above analyses, we concluded that our measures exhibit adequate construct reliability.

Discriminant Validity. In order to establish discriminant validity, we first examined each indicator's loading on its own construct as well as its cross loading on all other constructs. Table 2 shows that for each set of measures, the loadings on the intended construct are higher than the cross loadings on other constructs.

Next, we compared the AVE for each construct with the shared variance between all possible pairs of constructs (Fornell and Larcker 1981). Table 3 shows that AVE for each construct is higher than the squared correlation between the construct pairs, indicating that more variance is shared between the latent construct and its block of indicators than with another construct representing a different block of indicators. Together, the above analyses provide adequate evidence of discriminant validity.

Table 2. Loadings and cross-loadings for the measurement model

Construct	Item	1	2	3	4
1. Seriousness of Wrongdoing	Swrong1	**0.921**	0.305	0.326	0.065
	Swrong2	**0.924**	0.378	0.251	0.036
2. Anticipated Regret about Remaining Silent	RegS	0.370	**1.000**	0.402	-0.162
3. Whistleblowing Intention	Dc1	0.217	0.316	**0.851**	-0.067
	Dc2	0.324	0.391	**0.928**	-0.090
4. Fear of Retaliation	Fear1	0.045	-0.175	-0.109	**0.957**
	Fear2	0.057	-0.116	-0.067	**0.942**
	Fear3	0.055	-0.142	-0.051	**0.846**

Table 3. AVEs versus squares of correlations between constructs

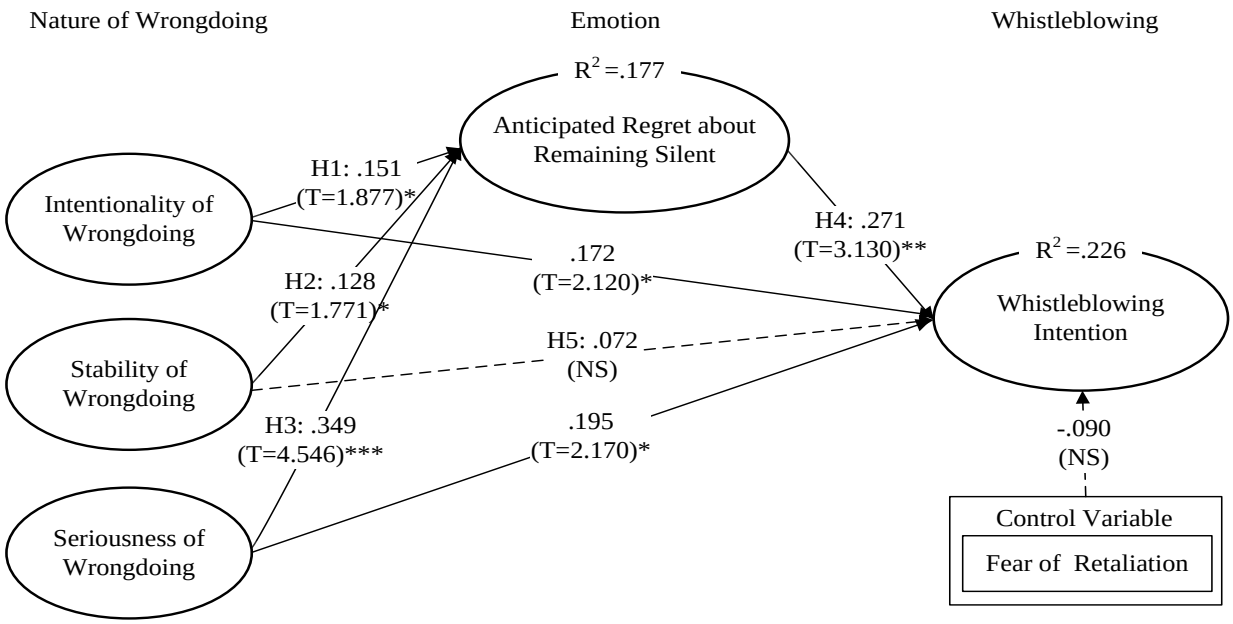
Construct	AVE	Seriousness of Wrongdoing	Whistleblowing Intention	Fear of Retaliation
Seriousness of Wrongdoing	0.852	-		
Whistleblowing Intention	0.793	0.559	-	
Fear of Retaliation	0.839	0.234	0.300	-

3.5.2.2. Structural Model Assessment

Having established that our measurement model was adequate and that the threat of common method bias was low, we then examined the structural model (Figure 2). To evaluate the explanatory power of the structural model, we assessed R^2 for each dependent variable. The model accounts for 22.6 percent of the variance in whistleblowing intention and 17.7 percent of the variance in anticipated regret about remaining silent. These R^2 values are sufficiently high to make the interpretation of path coefficients meaningful.

We used bootstrapping (1000 resamples) to obtain *t* values for our path coefficients (see Figure 2). Due to the directional nature of the hypotheses, one-tailed tests were used.

Figure 2. Structural model



Note: NS: path coefficient is not significant; Solid lines indicate significant paths and dashed lines indicate non-significant paths.
* p < .05, ** p < .01, ***p < .001 (one-tailed test)

Intentionality of wrongdoing had a positive effect on anticipated regret about remaining silent (β = 0.151, $p < 0.05$), thus supporting H1. Stability of wrongdoing had a positive effect on anticipated regret about remaining silent ($\beta = 0.128$, $p < 0.05$), thus supporting H2.

Seriousness of wrongdoing also had a significant positive effect on anticipated regret about remaining silent ($\beta = 0.349$, $p < 0.001$), thus supporting H3. Anticipated regret about remaining silent had a significant positive effect on whistleblowing intention ($\beta = 0.271$, $p < 0.01$), thus supporting H4. The direct effect of stability of wrongdoing on whistleblowing intention, however, was not found to be statistically significant. Thus, H5 was not supported.

We also examined the direct effects of intentionality of wrongdoing and seriousness of wrongdoing on whistleblowing intentions. These paths were part of our structural model but were not stated as formal hypotheses because they represented relationships that had already

been shown to be significant in prior research. Nevertheless, for replication purposes, we tested them as part of our PLS analysis. Consistent with prior research, the direct effects of intentionality of wrongdoing and seriousness of wrongdoing on whistleblowing intentions were found to be significant ($\beta = 0.172$, $p < 0.05$ and $\beta = 0.195$, $p < 0.05$ respectively).

3.5.3 Common Method Bias Assessment

We conducted Harmon's single-factor test to assess the threat of common method bias (Podsakoff and Organ 1986). The results indicated that no single factor accounts for the bulk of the covariance. We also conducted Lindell and Whitney's (2001) marker variable test that uses a theoretically unrelated construct to adjust the correlations among the principal constructs in the model. Common method bias can be detected when there is any high correlation of the marker variable with the principal constructs. We separately conducted the marker variable test with two variables that are not included in the model (age and full-time professional experience). We have little or no theoretical basis that suggests a relationship with the principal constructs. The average correlation among age and the principal constructs was r = 0.059 (T value = 0.960) and the average correlation among full-time professional experience and the principal constructs was r = 0.033 (T value = 0.860), leading to the conclusion that common method bias is not an issue in this study.

3.5.4 Post Hoc Analysis

Given the structure of our model and the results obtained above, we conducted a post hoc analysis to probe whether anticipated regret about remaining silent played a significant mediating role in our model. We used a bootstrapping approach to test whether the indirect effects were statistically significant (MacKinnon et al. 2004; Shrout and Bolger 2002). Specifically, we used the parameter estimates from the bootstrapping procedure in PLS, and calculated the standard

error of each indirect effect. We then calculated a t-statistic for each indirect effect by dividing its magnitude by the standard error. The bootstrapping approach is advantageous because it does not impose any distributional assumptions regarding the indirect effect. No significant indirect effects were found for intentionality of wrongdoing (t = 1.416, n.s.) or stability of wrongdoing (t = 1.535, n.s.). However, the indirect effect of seriousness of wrongdoing was found to be significant (t = 2.509, $p < 0.01$), indicating that anticipated regret about remaining silent partially mediates the relationship between this variable and whistleblowing intention.

Overall, four hypothesized paths (H1-H4) in our research model were found to be significant, and the results indicate that the model is capable of explaining a substantial amount of the variance in what is generally acknowledged to be a complex decision context (i.e., whistleblowing). Next, we discuss the limitations of our research, and its implications.

3.6 Discussion and Implication

We draw upon attribution theory and regret theory to investigate how the nature of wrongdoing (i.e., intentionality of wrongdoing, stability of wrongdoing, and seriousness of wrongdoing) and emotion (i.e., anticipated regret about remaining silent and fear of retaliation) influence whistleblowing intentions in the context of health information privacy violations. This study contributes to the literature in several important ways and represents the first attempt to investigate: (1) how the nature of wrongdoing (intentionality, stability, and seriousness) affects anticipated regret about remaining silent, and (2) how an important emotion (anticipated regret about remaining silent) influences whistleblowing intentions. Our study also confirms the direct effects of intentionality and seriousness of wrongdoing on whistleblowing intentions. Finally, our study is the first to systematically investigate whistleblowing within the context of health

information privacy violations. Before discussing implications for research and practice, we briefly turn to its limitations.

3.6.1 Limitations

By necessity, we limited our study to a small number of variables and it is likely that other factors may also influence emotions and whistleblowing intentions. In addition, we used a single-item measure for anticipated regret about remaining silent, which limits our ability to assess reliability. A single-item measure for anticipated regret has, however, been commonly used in prior research (e.g., Lankton and Luft 2008; Wong and Kwong 2007; Zeelenberg et al. 1998b).

There are instances in which it is appropriate to employ a single-item measure such as when constructs are unambiguous and sufficiently narrow (Wanous et al. 1997). Furthermore, Bergkvist and Rossiter (Bergkvist and Rossiter 2007) suggest that the use of a single-item measure can be justified when the object of the construct is "concrete singular." By this, they mean that the construct consists of one concrete object that is "easily and uniformly imagined" by the respondent (Bergkvist and Rossiter 2007). For our study, we constructed a single item measure of anticipated regret about remaining silent that was tailored to fit our scenario and which outlined a concrete outcome that would be associated with a decision to remain silent, thus leaving little room for imagination on the part of the respondent. Thus, we believe that the use of a single-item measure was appropriate in this instance.

Finally, some may question the use of student subjects for experiments such as ours on the grounds that students are either a poor substitute for managers (because they lack knowledge and experience that might be gained in the working world) or because the rich context of an organizational environment cannot be reproduced within the confines of a narrow laboratory

experiment. From this point of view, our methodological choice of an experiment represents a limitation. However, as we have noted earlier, our intention was not to generalize to a particular population, but rather to theory, and to do this by testing causal relationships. Thus, we argue that use of student subjects in our context is appropriate. In testing causal relationships between variables, internal validity is of paramount concern, and controlled experiments are known to be strong in this area. As noted by Cook and Campbell (1979, p. 84), "jeopardizing internal validity for the sake of increasing external validity usually entails a minimal gain for a considerable loss." Experimental designs should therefore be evaluated on whether they are likely to increase our understanding of human behavior, not on whether they mimic organizational settings (Dobbins et al. 1988).

3.6.2 Implications for Research

This study has important implications for research. First, we show that the perceived nature of wrongdoing influences anticipated regret about remaining silent. Our study is unique in that it provides empirical evidence linking attributions with anticipated regret about remaining silent. Consistent with regret theory (e.g., Reb 2008; Zeelenberg and Pieters 2007), our results suggest that when a decision is perceived to be an important one due to attributions of intentionality or stability, individuals are more likely to experience anticipated regret about remaining silent. Further, the results we obtained are consistent with Gundlach et al.'s (2003) theorizing that organizational wrongdoing that is attributed to intentional or stable causes is more likely to lead to emotional reactions. .

Second, our findings indicate that when seriousness of wrongdoing is high, individuals are more likely to experience anticipated regret about remaining silent. Our study is the first to provide empirical evidence for this relationship. These results suggest that in decision contexts

that involve serious wrongdoing, individuals will attach greater importance to whistleblowing decisions.

Third, our study is the first to empirically establish the linkage between anticipated regret about remaining silent and whistleblowing intention. Consistent with regret theory (e.g., Inman 2007; Reb 2008; Zeelenberg and Pieters 2007), the results of our study show that anticipated regret about remaining silent leads to greater whistleblowing intentions. These findings are also consistent with Edwards et al.'s (2009) theorizing on the relationship between anticipated regret and whistleblowing.

Fourth, we found a significant direct relationship between intentionality of wrongdoing and whistleblowing intention, thus providing replication of the findings reported by (Gundlach et al. 2008). We also found a significant direct relationship between seriousness of wrongdoing and whistleblowing intention which was also consistent with previously reported findings in this area (e.g. Miceli and Near 1985; Miceli and Near 1992; Miethe 1999).

Fifth, we did not find a significant relationship between stability of wrongdoing and whistleblowing intention, as we had hypothesized. Instead of having a direct effect on whistleblowing intention, stability may influence individuals' expectancies which, in turn, influence decision-making (Carroll and Payne 1977). Weiner (1992) further argues that stability can not only affect expectancy, but can also cause an emotional reaction which, in turn, can affect decision-making. In the context of the present study, this may explain why we did not observe a direct effect of stability on whistleblowing intention.

Finally, we conducted post hoc analysis to explore the mediating role of anticipated regret about remaining silent. We found that this variable plays a significant mediating role in the relationship between seriousness of wrongdoing and whistleblowing intention. While prior

studies (e.g. Miceli and Near 1985; Miceli and Near 1992; Miethe 1999) have suggested that seriousness of wrongdoing has a positive impact on whistleblowing intention, the underlying mechanism associated for this has been largely neglected. Our results demonstrate that anticipated regret about remaining silent is an important intervening variable that partially mediates the influence of seriousness of wrongdoing on whistleblowing intention.

3.6.3 Implications for Practice

This study offers important implications for practice as well. First, as concerns about violations of health information privacy increase, it is critical to understand how individuals perceive the nature of such violations and what motivates their whistleblowing intentions. Our findings clearly show that when violations of health information privacy are attributed to intentional or stable causes, or involve serious wrongdoing, individuals experience greater feelings of anticipated regret about remaining silent. When such an emotional response is triggered, whistleblowing intentions are strengthened. From an ethical standpoint, organizations that handle protected health information have a duty to ensure that it is used only for the intended and allowable uses for which it was collected. Exercising care in this area is the single most important thing that managers can do to prevent problems from erupting that would lead to whistleblowing. Having said that, we expect that there will be violations of health information privacy that occur from time to time.

From a practical standpoint, our results suggest that when such health information privacy breaches occur, managers should be particularly careful to explain the situation to employees so as to prevent them from making incorrect assumptions about the intentionality or stability of the company's actions. Managers should also be aware that once emotions such as anticipated regret are triggered, it is much more likely that employees will engage in whistleblowing.

In our study, our measures for whistleblowing intentions tapped into individuals' willingness to report perceived wrongdoing to external parties (i.e., outside the organization). From a practical standpoint, managers should do everything possible to instill a culture that promotes internal whistleblowing so that when breaches of health information privacy occur, they can be dealt with internally. When employees report perceived organizational wrongdoing to external parties this can destroy an organization's public image and erode the trust that others have for an organization and its products. By creating a climate that encourages employees to report organizational wrongdoing through secure internal communication channels and further by signaling to employees that appropriate action will be taken to correct any reported wrongdoing, an organization can properly resolve the issue reported internally and minimize reputational threats. Further, by creating an organizational climate that is conducive rather than hostile toward whistleblowing, managers can reduce the anticipated regret about internal whistleblowing that employees undoubtedly experience.

Appendix 3A: Scenario and Instruction for the Experiment

You work for a drug company that has developed a web-based system for individuals to maintain their Electronic Health Records. You have recently learned that your company is mining the protected health information and is using it to market its drug products. This use of protected health information violates the federal Health Insurance Portability and Accountability Act (HIPAA) and could cause financial, reputational, or other harm should the information fall into the wrong hands. **The management is *aware* that the mining of health records and its use for marketing purposes is in violation of HIPAA. This is *not the first time* your company has illegally mined health records and used them for marketing purposes.**

> Now, you are faced with the decision on whether or not to bring your company's actions to the attention of others outside the organization. If you decide to report your company's actions, you could lose your job. If you remain silent, however, one or more individuals could suffer financial, reputational, or other harm should their protected health information fall into the wrong hands.

Appendix 3B: Constructs and Measurement Items

Category	Construct	Construct Description	(Scale Format) Measurement Items	Informing Sources
Whistleblowing	Whistleblowing Intention	A decision to disclose illegal, unethical, or illegitimate IT practices of a company, to persons or organizations that may be able to effect action.	(Definitely Not/Definitely) (1-7 scale) 1. Would you report your company's actions with respect to HIPAA to an external auditor? 2. Would you tell an outside authority, like the Department of Health and Human Services (HHS), about your company's actions with respect to HIPAA?	(Gundlach 2003; Miceli and Near 1984; Miceli and Near 1985)
Nature of Wrongdoing	Intentionality of Wrongdoing	A type of causal attribution. It indicates whether one purposively or knowingly (intentional) brings out specific consequences or not purposively (unintentional).	The manipulation check asked whether the HIPAA violation of the company was intentional.	(Betancourt and Blair 1992; Weiner 1985)
	Stability of Wrongdoing	A type of causal attribution. It indicates whether one brings out specific consequences in constant/invariant effort (stable) or immediate/variant effort (unstable).	The manipulation check asked whether the illegal mining of health records was part of an ongoing pattern of behavior.	(Gundlach 2003; Weiner 1985)
	Seriousness of Wrongdoing	The extent to which a particular wrongful activity recurs or involves substantial consequences.	(Not Very Serious/ Very Serious) (1-7 scale) 1. How serious is the potential harm to individuals from HIPAA violations? (Not at all/Very Much)(1-7scale) 2. How much financial, reputational, or other harm could result from the use of protected health information for marketing purposes?	(Gundlach 2003; Miceli and Near 1985; Miceli and Near 1992)

Emotion	Anticipated Regret about Remaining Silent	A comparison-based anticipated emotion. It occurs when individuals imagine that negative consequences may occur from a decision and that the most preferred option (remaining silent) is not superior to another option (whistleblowing).	(No Regret/Very Much Regret) (1-7 scale) If you decided to remain silent on your company's action and then later found out that an individual was fired because his confidential health records of depression and suicide attempts were used to send free samples of an anti-depressant to his work address, to what extent would you regret your decision to remain silent?	(Wong et al. 2006; Zeelenberg et al. 1998b)
Control Variable	Fear of Retaliation	A basic, biologically primitive emotion. A type of anticipatory fear. It is likely to experience as individuals are contemplating their responses to a specific situation (retaliation).	(Strongly Disagree/ Strongly Agree)(1-7 scale) 1. I fear that my supervisor at the drug company would take action against me if I were to report the company's illegal activities to outsiders. 2. I fear that superiors in the drug company above the level of my supervisor would take action against me if I were to report the company's illegal activities to outsiders. 3. I fear that the drug company would NOT effectively protect me from reprisal if I disclosed illegal activities to outsiders.	(Keenan 1990)

Chapter 4

The Role of Anticipated Process Regret in Process Documentation Decision

4.1 Introduction

Process documentation is an explicit representation of a process, and includes complex relationships among goals, information, resources, activities, and people in a given workflow (Ungan 2006, p. 138). It also includes , process knowledge which describes reasons behind design decisions or design rationale (Ramesh and Dhar 1992).Process documentation helps the detection of critical issues (Ungan 2006) and facilitates knowledge sharing and shared understanding among the stakeholders, hence enhances collaboration (Biemborn et al. 2008).

However, Lethbridge et al. (2003), based on a qualitative study of documentation practices, find that software engineers resist process documentation because of the significant effort and costs involved in creating it. They further point out that project participants "consciously or subconsciously make value judgments and conclude that it's worthwhile to update only certain types of documentation" (p. 38). Xu and Ramesh (2008) suggest that the extent (or level of detail) of process documentation may affect process task performance under uncertainty. These studies suggest that the decision on the extent of process documentation (which Xu and Ramesh (2008) categorize as contextualized process documentation, generalized process documentation, and no process documentation) that is created for a project is made based on the decision makers' judgment about the level of uncertainty caused by the project environment, expected time and effort involved in creating the documentation, and the expected outcomes.

To mitigate uncertainty, decision makers often rely on intuition or gut feeling that is based on emotional experiences such as experienced regret or anticipated regret (Lankton and Luft 2008). In contrast to other types of emotions (such as fear, anger, shame, and guilt), regret significantly influences one's decision making (Zeelenberg and Pieters 2007). Regret is a comparison-based emotion because it occurs when "the most preferred alternative is not necessarily superior to another alternative" (Janis and Mann 1977a, p. 223). Bell (1982) and Lomes and Sugden (1982a) conclude that decision makers take their feeling of regret into account while making decisions under uncertainty. Regret theory has been used to explain decision making behaviors in numerous situations including the following: consumer purchase decision (Simonson 1992b; Tsiros and Mittal 2000), investment decisions (Lin et al. 2006a), emotional insurance (Gilbert et al. 2004b), and escalation in project management (Ku 2008; Wong and Kwong 2007). Especially, anticipated regret is a critical input in decision making under uncertainty because it is an affective response to anticipated outcomes of a decision (Zeelenberg and Pieters 2007). Prior studies establish that affective responses are a critical driver of decision making behavior (Passyn and Sujan 2006). Furthermore, the literature indicates that when decision makers are accountable and responsible for the decision outcome, they are more likely to experience regret (Passyn and Sujan 2006; Zeelenberg et al. 2000b).

Prior literature on process documentation points out that an inappropriate decision on the extent of process documentation can create significant problems such as the loss of design rationale and design decisions (Ramesh and Dhar 1992), miscommunication and misunderstanding among business partners (Biemborn et al. 2008), and wasted time, effort, and resources due to excessive documentation (Lethbridge et al. 2003). However, prior research has

not devoted much attention to examining how the decision on the extent of process documentation is made by project personnel in IT projects that are characterized by uncertainty.

The literature on regret suggests that, in order to mitigate uncertainty, decision makers use a reference point and compare their decision alternatives based on this reference point (Kahneman 1992). Prospective losses or gains relative to each reference point can influence the feeling of anticipated regret, and thus lead to regret minimizing choices (Lin et al. 2006a). Therefore, we seek to understand how decision makers use a reference point and compare process documentation options (e.g., contextualized, generalized, or no process documentation) and, how they take emotion, specifically anticipated regret, into account while making the decision to invest in process documentation.

Furthermore, agile development differs significantly from traditional development in terms of its emphasis on informal communication among project stakeholders in contrast to formal documentation (Fernandez and Fernandez 2008; Vinekar et al. 2006). However, the question on how decision makers who are involved in such development projects make decisions on investing in process documentation remains unexplored.

Specifically, the following research questions guide this study:

- *Does requirements uncertainty, accountability, and the type of project (traditional vs. agile) influence anticipated regret to invest in process documentation?*
- *Does anticipated regret influence the decision to invest in different levels of process documentation?*

To answer these questions, we conducted a scenario-based experiment with IS project managers. In section 4.2, we present literature review for this research; in the section 4.3, we develop our research framework, hypotheses and their rationale; in sections 4.4 and 4.5, research

methodology and data analysis are explicated; and finally, in section 4.6, we discuss implications and contributions to theory and practice.

4.2 Literature Review

4.2.1 Regret Theory

4.2.1.1. Counterfactual Thinking

People experience regret when the counterfactual outcome of a forgone alternative is better than the actual outcome of a chosen alternative, and people rejoice when they face the opposite condition (Inman et al. 1997). The psychological comparison process, in which people compare actual outcomes with alternative outcome(s) or compare anticipated outcomes of the preferred option with anticipated outcomes of the alternatives, is called counterfactual thinking (Hetts et al. 2000; Roese 1997). Counterfactual ("contrary to the facts") (Roese 1997, p. 133) thinking generally uses conditional propositions that consist of two components: precedence (e.g., "if only I had done A") and its outcomes (e.g., "B would not have happened"). Counterfactual thinking leads people to consider alternatives and regret avoidance behaviors (Hetts et al. 2000; Zeelenberg and Pieters 2007). The location of a reference point relative to which an outcome is evaluated by a typical decision maker (Bazerman and Moore 2009) plays an important role in the valuation of the gain or loss in the comparison (Kahneman 1992).

4.2.1.2 Anticipated Regret

Regret is experienced as a sinking feeling or a self-blaming feeling and with thoughts about the mistakes made. It is often accompanied by a desired goal to undo the decision (Zeelenberg et al. 1998a). Anticipated regret is a comparison-based emotion that influences decision making (Zeelenberg and Pieters 2007). When decision makers realize that the current situation is uncertain and a decision is important and difficult, they anticipate future regret (Zeelenberg and

Pieters 2007). Also, when the anticipated outcome of the most preferred option is not necessarily superior to alternatives available, they experience anticipated regret (Janis and Mann 1977a). Anticipated regret involves counterfactual thinking on future outcomes of an option (Hetts et al. 2000). When self-accountability is high, regret is more likely to occur (Passyn and Sujan 2006).

These feeling of anticipated regret leads decision makers to change their decisions and to choose regret minimizing options (Janis and Mann 1977a; Zeelenberg and Pieters 2007). Anticipated regret leads decision makers to consider future anticipated outcomes at the current time, and hence facilitates regret avoidance (Reb 2008). For instance, in order to avoid anticipated regret related to making a wrong decision, consumers prefer purchasing an item currently on sale rather than waiting for a better sale (Simonson 1992b). They also prefer a higher-priced, well known brand, rather than a less expensive, lesser known brand. Since regret theory has been used to a variety of domains for understanding decision making under uncertainty, it is very suitable for studying decision making about the creation of process documentation under uncertainty. Among the various types of uncertainty that characterize IT projects, requirements uncertainty has been recognized as very critical in shaping decisions about the IS development process.

4.2.2 Requirements uncertainty

In IT projects, both traditional or agile, requirement analysis is the most critical stage since its influence on other stages is inevitable (Zmud 1980). According to Nidumolu (1995; 1996), requirements uncertainty occurs due to requirement instability, requirement diversity, and requirement unanalyzability. Nidumolu (1996, p. 79-80) defines *requirement instability* as "the extent of change in user requirements over the course of the project," *requirement diversity* as "the extent to which users differ among themselves in their requirements," and *requirement*

analyzability as " the extent to which the process of converting user needs to a set of requirements specifications can be reduced to mechanical steps or objective procedures." In this study, we use requirement instability as a measure of uncertainty because continuously changing requirements is a major project risk factor (Wallace and Keil 2004). Requirement instability generally results in the deletion or modification of existing requirements as well as the addition of new requirements (Pfahl and Lebsanft 2000). This influences project cost, project schedule and the quality of products and services (Stark et al. 1999).

Requirements uncertainty can create anticipated regret (Bell 1982) which is taken into account in decision making (Bell 1982; Loomes and Sugden 1982a; Zeelenberg and Pieters 2004). When decision makers are uncertain on decision outcomes and the environment relevant to a decision, it is hard for them to think through all possible decision paths and outcomes (van Dijk and Zeelenberg 2005). Therefore, they often rely on gut feelings grounded in experienced regret or anticipated regret (Lankton and Luft 2008). In our study, we suggest that when requirements uncertainty is high, decision makers may take more vigilant actions by documenting contextualized process knowledge in order to mitigate the uncertainty and avoid anticipated regret.

4.2.3 Accountability

Tetlock (1992, p. 331) describes accountability as "the implicit or explicit expectation that one be called on to justify one's beliefs, feelings, and actions to others." Though the notion may appear to be similar to the attribution of responsibility, it is distinctly different. While accountability is based on "performance evaluation or public feedback pressure," responsibility is based on "private commitment to the importance of the task, particularly the judgment outcome" (Rozelle and Baxter 1981, p. 438). Rozelle and Baxter (1981) find that accountability

presents more immediate and visible impact on judgment behavior than responsibility. Further Smith et al. (1993) argue that accountability is more directly related to emotion than responsibility. Self-accountability related to guilt and regret leads to preventive or corrective behaviors (Smith and Lazarus 1993). In IT projects, accountability can be a critical factor that influences process documentation decision for the following reasons: first, it improves goal salience in decision making (Quinn and Schlenker 2002); second, due to cognitive dissonance, it leads decision makers to invest significant efforts towards justifying their conduct (Tetlock et al. 1989); third, it facilitates motivation and improves task performance (Lerner and Tetlock 1999; Quinn and Schlenker 2002).

4.2.4 Types of Process Documentation

Xu and Ramesh (2008) propose two types of process knowledge: generalized knowledge and contextualized knowledge. General knowledge is defined as "knowledge that is high in domain knowledge specificity but low in contextual knowledge specificity" (Xu and Ramesh 2008, p. 282). Algorithms, mathematical models, and general rules are examples of generalized knowledge. Contextualized knowledge is defined as knowledge that is "both high domain specificity and high contextual knowledge specificity" (Xu and Ramesh 2008, p. 284). The components of contextualized knowledge embrace problem specification, information cues on a context of problems, strategic knowledge, and causal knowledge. Based on two types of process knowledge proposed by Xu and Ramesh (2008), in this study, we refer to 'documentation of contextualized knowledge' as *contextualized process documentation* and 'documentation of generalized knowledge' as *generalized process documentation*. *No process documentation* simply indicates that no documentation of any process knowledge is created. Contextualized process documentation includes contextualized problems that need to be resolved, the context in

which the problem was faced, alternative solutions considered, assumptions made, the solution that was adopted, and the reasons for adopting the chosen solution. Generalized process documentation includes only the problems that need to be resolved and the solutions adopted. Generally, as the level of detail in process documentation increases, process documentation becomes more complex and requires more time and effort to create it (Ungan 2006).

4.2.5 Reference Point

Reference points which are "characterized by the abrupt changes in the valuation of gains and losses and of acceptable or reprehensible behavior" (Kahneman 1992, p. 296) play an important role in decision making under uncertainty. According to Bazerman and Moore (2009), "the typical decision maker evaluates outcomes relative to a neutral reference point" (p. 64). Tsiros (1998) identifies two reference points: expected outcome and outcome of the forgone alternative. In his study, best-performing forgone option serves as a reference point for comparison and affects regret when the chosen outcome is better than the expectation. In contrast, worst-performing forgone option serves as a reference point for comparison and affects regret when chosen outcome is worse than the expectation. Extending Tsiros's work (1998), Lin et al. (2006a) find multiple reference points used by stock investors (p. 790): (1) the value of their outcomes might have been had they not invested; (2) their expected outcomes; and (3) the best-performing unchosen stocks. These studies show how reference points in multiple option situations can influence *experienced regret about post-choice valuation*. In IT projects, project managers are often required to compare multiple options related to the extent of process documentation: contextualized process documentation, generalized process documentation, and no process documentation (Lethbridge et al. 2003).

Prior research further suggests that, in pre-choice valuation, anticipated alternative outcome(s) also can serve as reference points for comparison (Bell 1982; Boles and Messick 1995; Loomes and Sugden 1982a). In a study on how multiple reference points affect the evaluation of outcomes and decisions, Boles and Messick (1995, p. 262) argue that, an alternative outcome is more likely to be evoked as a reference point when: (1) another choice would have led to the alternative outcome; (2) social comparison with others who received the alternative outcome is done; and (3) the alternative outcome is in a different evaluative domain than the outcome received (i.e., it is negative when the outcome received is positive). Zeelenberg and van Dijk (1997) point out that *anticipated regret about pre-choice valuation* can be affected by multiple reference points. They suggest several potential reference points at which anticipated outcomes can be evaluated (p. 683): the status quo, the aspiration level, and the outcomes of different alternatives. In pre-choice valuation, an option can be more attractive to decision makers when (1) its anticipated outcome will be more positive relative to the outcome of status quo, (2) its anticipated outcome will be more positive relative to the alternative outcome, and (3) it may lead to a type of affective contrast (i.e., positive vs. negative) that will emphasize its positivity (Boles and Messick 1995, p. 270). Thus, anticipated alternative outcome(s) can serve as reference points in pre-choice valuation.

In the context of process documentation decision in traditional IT projects, for instance, when a decision maker's most preferred option, viz. contextualized process documentation, is superior to generalized process documentation due to high requirements instability of the IT project and high accountability, the decision maker can experience low level of anticipated regret. Thus, the low anticipated regret about contextualized process documentation and high anticipated regret about generalized process documentation may lead a decision maker to choose the former. In this

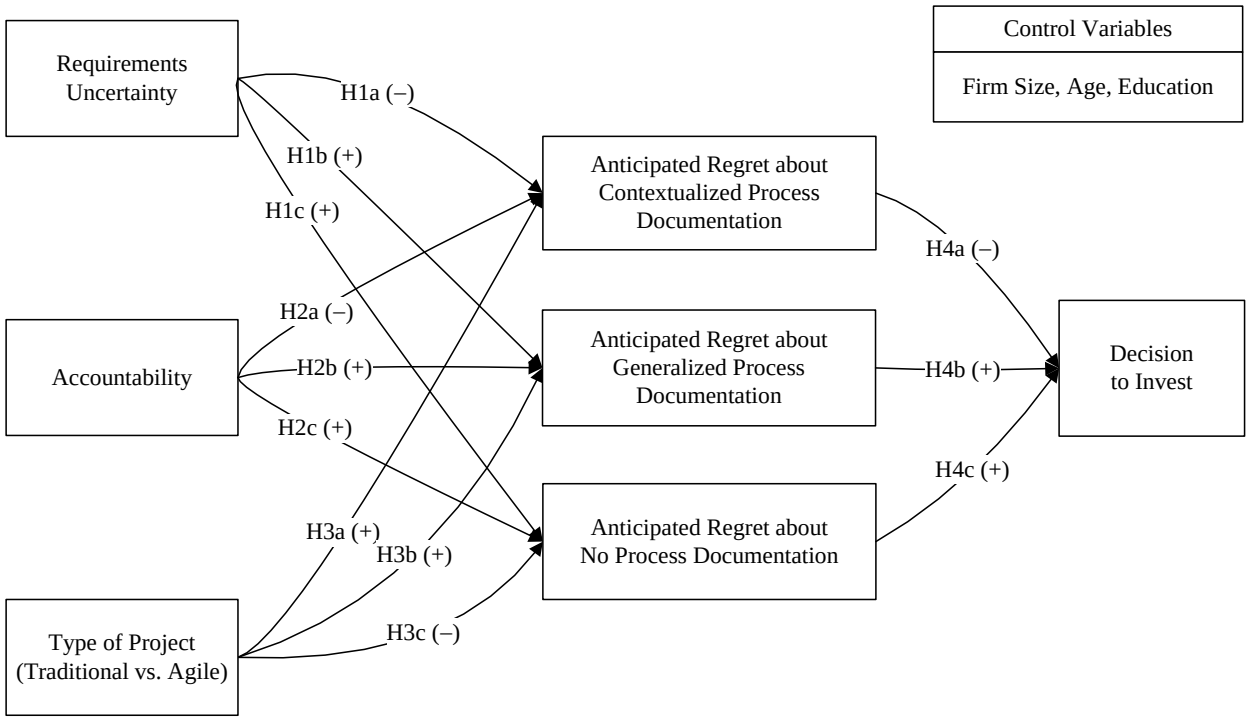


Figure 1. Research Model

case, the generalized process documentation option serves as a reference point in the pre-choice valuation.

4.3 Research Model and Hypotheses

4.3.1 Research Model

Our research model presented in Figure 1 depicts how requirements uncertainty, accountability, and the type of project influences anticipated regret about the extent of process documentation (contextualized, generalized, and no process documentations) and how anticipated regret influences the decision to invest in process documentation. In the next section, we develop research hypotheses and their rationale based on current literature.

4.3.2 Hypotheses and Their Rationale

4.3.2.1 Requirements uncertainty to Anticipated Regret about Process Documentation (H1a-H1c)

As user requirements keep changing over the course of a project, requirements uncertainty increases. As requirements uncertainty increases, decision makers' pre-choice valuation of the contextualized process documentation option may increase. Here, reference points play an important role in creating regret (Lin et al. 2006a; Tsiros 1998). Prior studies (Bell 1982; Boles and Messick 1995; Loomes and Sugden 1982a) suggest that anticipated alternative outcomes can serve as reference points for comparison in pre-choice valuation because decision makers are more likely to prefer anticipated positive outcome of an option to anticipated negative outcomes of alternatives (Boles and Messick 1995). If decision maker's preferred option is not superior to the other alternatives, then regret is evoked (Janis and Mann 1977a). The comparison process, called counterfactual thinking, can involve upward counterfactuals or downward counterfactuals (Roese 1994). Upward counterfactuals depict "alternatives that are better than what actually happened", while downward counterfactuals depict "alternatives that are worse than reality" (Roese 1994, p.805-6). In pre-choice valuation situations where the outcomes of a decision and its alternatives are not realized yet, anticipated upward and downward counterfactuals are commonly used (Hetts et al. 2000). For instance, when a project manager compares generalized process documentation with the other alternatives, s/he may value the foregone alternatives as either better (e.g., "if only I would choose contextualized process documentation, I could preserve more process knowledge") or worse (e.g., "at least, I would not lose general process knowledge"). The counterfactuals can create negative emotions such as regret (Hetts et al. 2000; Roese 1994). In the case above, the upward counterfactual may evoke high anticipated regret

Table 1. Summary of Rationale for H1a-H1c

	Requirements uncertainty			
	Low		High	
Option	Preferred Option: GPD		Preferred Option: CPD	
Contextualized Process Documentation (CPD)	• Upward counterfactual • RP: GPD	Greater anticipated regret about CPD	• Downward counterfactual • RP: GPD/ NPD	Less anticipated regret about CPD
Generalized Process Documentation (GPD)	• Downward counterfactual • RP: NPD	Less anticipated regret about GPD	• Upward counterfactual • RP: CPD	Greater anticipated regret about GPD
No Process Documentation (NPD)	• Upward counterfactual • RP: GPD	Greater anticipated regret about NPD	• Upward counterfactual • RP: CPD	Greater anticipated regret about NPD

Note: RP stands for reference point.

about choosing generalized process documentation and low anticipated regret about choosing contextualized process documentation. The downward counterfactual may elicit low anticipated regret about choosing generalized process documentation. Upward counterfactuals may motivate decision makers to improve performance, while downward counterfactuals may make decision makers feel better (Roese 1994).

Under high levels of requirements uncertainty, decision makers compare anticipated outcomes of the preferred option (say, contextualized process documentation) with a reference point, (say, anticipated outcome of generalized process documentation) (see Table 1). Engaging in downward counterfactual thinking, decision makers can realize the benefits of contextualized process documentation option (e.g., process knowledge preservation) over generalized process documentation option. Thus, anticipated regret about contextualized process documentation is less likely to occur. This is because, as requirements uncertainty increases, contextualized process documentation option is superior relative to the generalized documentation option. Although contextualized process documentation takes more time and effort than the generalized

documentation option, it is superior for the purpose of mitigating requirements uncertainty. Therefore, we hypothesize that:

H1a: A higher level of *requirements uncertainty* is more likely to lead to less *anticipated regret about contextualized process documentation.*

As requirements uncertainty increases, we propose, decision makers' pre-choice valuation of generalized process documentation option decreases. Decision makers use upward counterfactuals and compare the anticipated outcome of generalized process documentation option with a reference point, ie., the anticipated outcome of contextualized process documentation (see Table 1). Since the generalized process documentation option is not necessarily superior to the contextualized documentation option (e.g., due to process knowledge loss), we expect that anticipated regret about generalized process documentation is more likely to occur as requirements uncertainty increases. Decision makers may also engage in downward counterfactuals (e.g., "at least, I would not lose general process knowledge"), when compared to creating no process documentation. However, prior studies suggest (Lin et al. 2006a) that downward counterfactual does not reduce regret when decision makers perceive a decision as controllable. We argue that decision makers perceive the process documentation decision as controllable. Therefore, while upward counterfactual influences the anticipated regret, downward counterfactual does not influence anticipated regret.

H1b: A higher level of *requirements uncertainty* is more likely to lead to greater *anticipated regret about generalized process documentation*.

We also propose that as requirements uncertainty increases, decision makers' pre-choice valuation of the 'no process documentation' option decreases. Decision makers engage in upward counterfactual to compare the anticipated outcome of 'no process documentation' option with reference point(s), viz., anticipated outcomes of generalized and/or contextualized process documentation (see Table 1). From the perspective of benefits, 'no process documentation' option is not necessarily superior to contextualized and/or generalized process documentation options. Zeelenberg et al. (2002) suggest that when decision makers anticipate negative consequence of an option, they experience more regret on inaction than on action. Therefore, even though requirements uncertainty is low, we suggest that decision makers experience high levels of anticipated regret about creating no process documentation. But as requirements uncertainty increases, the level of anticipated regret associated with creating no process documentation increases even more.

H1c: A higher level of *requirements uncertainty* is more likely to lead to greater *anticipated regret about no process documentation.*

4.3.2.2 Accountability to Anticipated Regret about Process Documentation (H2a-H2c)

We propose that accountability influences anticipated regret associated with process documentation options. Passyn and Sujan (2006) find a positive relationship between high self-accountability and the regret experienced by decision makers. When accountability is high (for example, when the decision is subject to an audit by an independent party), decision makers are likely experience the pressure to perform well. Therefore, they are more careful in their evaluation of the anticipated outcomes of alternatives. Rozelle and Baxter (1981) suggest that 'attention effect' may play a role in this situation. High accountability facilitates motivation and

Table 2. Summary of Rationale for H2a-H2c

	Accountability			
	Low		High	
Option	Preferred Option: GPD		Preferred Option: CPD	
Contextualized Process Documentation (CPD)	• Upward counterfactual • RP: GPD	Greater anticipated regret about CPD	• Downward counterfactual • RP: GPD/ NPD	Less anticipated regret about CPD
Generalized Process Documentation (GPD)	• Downward counterfactual • RP: NPD	Less anticipated regret about GPD	• Upward counterfactual • RP: CPD	Greater anticipated regret about GPD
No Process Documentation (NPD)	• Upward counterfactual • RP: GPD	Greater anticipated regret about NPD	• Upward counterfactual • RP: CPD	Greater anticipated regret about NPD

Note: RP stands for reference point.

improves goal salience in decision making (Quinn and Schlenker 2002). Also decision makers tend to invest significant effort towards justifying their conduct (Tetlock et al. 1989).

Here, decision makers also engage in upward and downward counterfactuals to compare a preferred option with reference point(s) (see Table 2). Under high level of accountability, decision makers compare anticipated outcomes of the preferred option (contextualized process documentation) with a reference point (say, anticipated outcome of generalized or no process documentation) (see Table 2). Engaging in downward counterfactual thinking, decision makers can realize the benefits of contextualized process documentation option (e.g., process knowledge preservation for future need) over generalized process documentation option. Thus, anticipated regret about contextualized process documentation is less likely to occur. This is because, as requirements uncertainty increases, contextualized process documentation option is superior relative to the generalized documentation option. Therefore, we hypothesize that:

H2a: A higher level of *accountability* is more likely to lead to less *anticipated regret about contextualized process documentation*.

However, decision makers with high accountability can experience high anticipated regret about creating generalized process documentation and no process documentation. Here the same mechanism of upward counterfactuals (discussed in H1b and H1c) influence decision makers' pre-choice valuation of generalized or no process documentation options (Lin et al. 2006a). Because either generalized or no process documentation option is not necessarily superior to the contextualized documentation option (e.g., due to the loss of design rationale and design decisions, miscommunication among business partners) (Biemborn et al. 2008; Ramesh and Dhar 1992), we expect that anticipated regret about generalized process documentation is more likely to occur as accountability increases. Thus, we hypothesize that:

H2b: A higher level of *accountability* is more likely to lead to greater *anticipated regret about generalized process documentation*.

Particularly, from the perspective of benefits, 'no process documentation' option is not necessarily superior to other process documentation options. As mentioned in H1c, we also expect that even though accountability is low, decision makers experience high levels of anticipated regret about no process documentation. However as accountability increases, the level of anticipated regret associated with no process documentation increases even more.

H2c: A higher level of *accountability* is more likely to lead to greater *anticipated regret about no process documentation*.

4.3.2.3 Type of Project to Anticipated Regret about Process Documentation (H3a-H3c)

Important differences between traditional and agile development projects have been well established in the literature. First, traditional projects are defined with linear processes and

management approaches and stable, consistent requirements (Augustine et al. 2005). Traditional projects try to reduce changes in the course of the project through rigorous requirements gathering, analysis, and design under a controlled schedule. They focus on prediction and control. In contrast, in agile projects, changes are inevitable. They focus on achieving adaptation and innovation over a linear development process (Vinekar et al. 2006). Second, traditional projects are characterized by well-documented and understood features or requirements. They tend to adhere to well-documented matrices for managing budget, schedule, and scope. On the other hand, agile projects discover project requirements while in iterative development cycles. Agile projects focus on a project, instead of adherence to a process such as creating rigorous documentation (Fernandez and Fernandez 2008).

We propose that agile development projects differs from traditional development projects in terms of the influence on anticipated regret on creating different types of process documentations. The same mechanism of upward counterfactual occurred in H1b or H1c can be applied in decision makers' pre-choice valuation of contextualized or generalized process documentation option (Lin et al. 2006a) (see Table 3). Compared with decision makers in traditional projects,

Table 3. Summary of Rationale for H3a-H3c

	Type of Project			
	Traditional		Agile	
Option	Preferred Option: CPD or GPD		Preferred Option: NPD	
Contextualized Process Documentation (CPD)	• Downward counterfactual • RP: GPD	Less anticipated regret about CPD	• Upward counterfactual • RP: GPD/ NPD	Greater anticipated regret about CPD
Generalized Process Documentation (GPD)	• Downward counterfactual • RP: NPD	Less anticipated regret about GPD	• Upward counterfactual • RP: NPD	Greater anticipated regret about GPD
No Process Documentation (NPD)	• Upward counterfactual • RP: GPD	Greater anticipated regret about NPD	• Downward counterfactual • RP: GPD/ CPD	Less anticipated regret about NPD

Note: RP stands for reference point.

decision makers in agile projects are more likely to desire to minimize the cost of moving information between people and prefer communicating in person, instead of making an effort in documentation (Cockburn and Highsmith 2001). Because either contextualized or generalized process documentation option is not necessarily superior to no process documentation option (e.g., due to wasting resources in creating documentations), we expect that anticipated regret about contextualized and generalized process documentations is more likely to occur in agile projects. Therefore, we hypothesize that:

H3a: When compared to traditional projects, agile projects are more likely to lead to greater *anticipated regret about contextualized process documentation*.

H3b: When compared to traditional projects, agile projects are more likely to lead to greater *anticipated regret about generalized process documentation*.

The same mechanism of downward counterfactual occurred in H1a also influences decision makers' pre-choice valuation of no process documentation option (Lin et al. 2006a) (see Table 3). Because agile project environments involve high uncertainty and risk, decision makers in agile projects consider delivering high-quality products and services to the customer quickly more important than creating extensive documentation.(Vinekar et al. 2006). Engaging in downward counterfactual, decision makers can realize the advantages of no process documentation option (e.g., saving resources to create documentations)) over contextualized or generalized process documentation option. Thus, anticipated regret about documentation is less likely to occur. This is because, in agile project environments, no process documentation option is superior relative to the other documentation options. Therefore, we hypothesize that:

H3c: When compared to traditional projects, agile projects are more likely to lead to less *anticipated regret about no process documentation*.

4.3.2.4 Anticipated Regret about Process Documentation to Decision to Invest in Process Documentation (H4a-H4c)

Decision makers apply their anticipated regret in subsequent decision making (Bell 1982; Loomes and Sugden 1982a; Zeelenberg and Pieters 2004). Since decision makers are regret averse, they are more likely to choose a regret minimizing option (e.g., Zeelenberg & Pieters, 2007; Reb, 2008). In Wong and Kwong (2007)'s study, for example, decision makers who have high anticipated regret about withdrawal from a project are more likely to escalate their commitment, while those who have high anticipated regret about persistence are less likely to escalate their commitment. In similar spirit, we propose that high anticipated regret about creating contextualized process documentation is less likely to lead decision makers to invest time and effort involved in creating this documentation.

H4a: A higher level of *anticipated regret about contextualized process documentation* is less likely to lead to a *decision to create contextualized process documentation.*

On the contrary, decision makers who have high anticipated regret about creating generalized process documentation are more likely to invest time and effort in creating contextualized process documentation. Therefore we hypothesize that:

H4b: A higher level of *anticipated regret about generalized process documentation* is more likely to lead to a *decision to create contextualized process documentation*.

Based on the regret aversion tendency, we also propose that decision makers who have high anticipated regret about creating no process documentation tend to invest more time and effort in process documentation.

H4c: A higher level of *anticipated regret about creating no process documentation* is more likely to lead to a *decision to create generalized or contextualized process documentation*.

4.3.2.5 Control Variables

We also added the following demographic variables as control variables that may influence decision to invest in process documentation: *firm size, age, and level of education*.

4.4 Research Methodology

To evaluate the hypotheses presented in Figure 1, we conducted a scenario-based experiment (see Appendix 4A). This study explores a complex human decision making process, which involves investigating relationships among requirements uncertainty, accountability, the type of project, emotion (anticipated regret), and a decision to invest in process documentation. The experiment involves a 2 x 2 x 2 factorial design, in which three factors are involved: type of project, requirements uncertainty, and uncertainty. Type of project, a setting, was varied between traditional and agile software development projects. The level of requirements uncertainty and the level of accountability were manipulated independently. Through manipulation of independent variables, a scenario based approach can allow researchers to capture many essential features of real contexts (Straub and Karahanna 1998). In prior research on regret, scenario-based experiments have been widely used in various fields including: consumer decision making (Simonson 1992b; Tsiros and Mittal 2000), multiple reference points in investment decision

making (Lin et al. 2006a), regret aversion in the decision to play a lottery (Zeelenberg and Pieters 2004), escalation of commitment (Wong and Kwong 2007), and information technology real options (Lankton and Luft 2008).

4.4.1 Subjects

Data were gathered from 315 IT project leaders and managers, leaving us with 296 usable responses. The characteristics of these subjects were presented in Table 4. Using contacts that we have established with professional organizations such as the Project Management Institute and IT industry association, we recruited subjects for participation in the study. Snowball sampling was used where additional subjects were recruited based on referrals from participants in the study.

Table 4. Subject Characteristics

Demographics	N = 296 (Mean)
Age	40.3
Years of IT experience	15.6
Years of project management experience	10.6
Firm size (# of employee) • < 10000 • =< 100000 • =< 400000	 20 % 71 % 9 %
Highest education level • Undergraduate • Master • Ph.D.	 48 % 50 % 2 %

Subjects participated in the experiment by completing an online survey. The subjects were randomly assigned to each condition.

4.4.2 Scenario and Procedure

After reading basic instructions about the experiment, subjects were asked to read a scenario about process documentation decision making in software development project. They were asked to play the role of an IT project manager (see Appendix 4A). The setting was varied in traditional

and agile projects. The level of requirements uncertainty (high or low), the level of accountability (high or low) were manipulated independently to generate eight treatment conditions. The common information in the scenario includes (1) a brief description of project task and process documentation decision in a software project; (2) a description on three possible decision options: detailed (contextualized) process documentation, basic (generalized) process documentation, and no process documentation; and (3) a description on conditions: the requirements uncertainty level (high or low), the accountability level (high or low), and the type of project (agile or traditional project). Manipulation checks were used to ensure that the subjects perceive the treatments properly (Boudreau et al. 2001; Straub et al. 2004). Subjects answered questions on their levels of anticipated regret about three process documentation options and the decision to invest in process documentation. The instrument also contains measures for control variables and basic demographic information (see Appendix 4B).

4.4.3 Constructs and Measures

All key constructs in the model were measured using multiple-items, 7-point likert scales. Measures for anticipated regret about different levels of three process documentation options were adapted from the literature (Boudreau et al. 2001; Straub et al. 2004). New scales were developed for the 'decision to invest in process documentation' based on literature review. All the instruments were refined with a small group of IT professionals and academic experts. Pilot tests were conducted with business school students enrolled in information systems courses at a large urban university in the southeastern United States and refined the adapted scales and to identify unanticipated difficulties before conducting the main experiment (Straub 1989). The measurement items are summarized in the Appendix 4B. An overview of the manipulation items and the main constructs is provided in Table 5.

Table 5. Constructs Used in the Study

Construct	Description	Role in Nomology	Sources
Requirements uncertainty	Requirements uncertainty occurs due to requirement instability, requirement diversity, and requirement unanalyzability. In this study, *requirement instability* (the extent of change in user requirements over the course of the project) is adapted to measure requirements uncertainty.	Independent variable (Manipulated)	(Nidumolu 1995; Nidumolu 1996)
Accountability	The implicit or explicit expectation that one be called on to justify one's beliefs, feelings, and actions to others.	Independent variable (Manipulated)	(Lerner and Tetlock 1999), (Quinn and Schlenker 2002), (Zhang and Mittal 2005)
Type of Project	*Traditional projects* are defined with linear processes and management approaches and stable, consistent requirements. *Agile projects* with flexibility discover project requirements while doing the project in iterations and reducing uncertainty. Agile projects focus on achieving adaptation and innovation over adherence to a defined development process.	Independent variable (setting)	(Cockburn and Highsmith 2001) (Augustine et al. 2005) (Vinekar et al. 2006)
Anticipated Regret about Contextualized Process Documentation	A comparison-based anticipated emotion. It occurs when individuals imagine that negative consequences may occur from a decision and that the most preferred option (contextualized process documentation) is not superior to other option(s) (generalized and/or no process documentations).		(Simonson 1992b), (Zeelenberg et al. 1998b), (Tsiros and Mittal 2000), (Wong and Kwong 2007), (Lankton and Luft 2008)
Anticipated Regret about Generalized Process Documentation	A comparison-based anticipated emotion. It occurs when individuals imagine that negative consequences may occur from a decision and that the most preferred option (generalized process documentation) is not superior to other option(s) (contextualized and/or no process documentations).		
Anticipated Regret about No Process Documentation	A comparison-based anticipated emotion. It occurs when individuals imagine that negative consequences may occur from a decision and that the most preferred option (no process documentation) is not superior to other option(s) (contextualized and/or generalized process documentations).		
Decision to Invest in Process Documentation	A decision on the extent (level of detail) of process documentation (contextualized, generalized, or no process documentation)	Ultimate Dependent Variable	(Ungan 2006; Xu and Ramesh 2008)

4.5 Analysis and Results

4.5.1 Manipulation Checks

Manipulation checks were conducted to examine whether requirements uncertainty and accountability manipulations were working. The manipulation check for *requirements uncertainty* asked subjects to indicate whether they perceived project requirements to be significantly different from development to maintenance (1 = strongly disagree (i.e., low level of requirements uncertainty); 7 = strongly agree (i.e., high level of requirements uncertainty)). The manipulation check for *accountability* asked subjects to indicate whether they perceived the impact of the decision to create process documentation on their career and compensation when they will (or will not) be subject to process audit (1 = strongly disagree (i.e., low level of accountability); 7 = strongly agree (i.e., high level of accountability)).

To see whether manipulations work, we conducted regression analysis where we can predict the actual assignment of groups via the manipulation checks (Perdue and Summers 1986). Each treatment was coded as a 1 (for high) or 0 (for low) based on the type of scenarios. This binary data and the interval level data from manipulation questions were used for analysis. If researchers can significantly predict a relationship, it indicates that the manipulation works. Both requirements uncertainty ($\beta = 0.900$, $p < 0.001$) and accountability ($\beta = 0.286$, $p < 0.001$) were significantly predicted, indicating that the manipulations were effective.

4.5.2 Common Method Bias Assessment

To assess the threat of common method bias, we conducted the following: (1) Harmon's single-factor test (Podsakoff and Organ 1986), (2) marker variable test (Lindell and Whitney 2001), and (3) correlation analysis (Bagozzi et al. 1991). The results of Harmon's single-factor test indicated that no single factor accounts for the bulk of the covariance. Next, we conducted Lindell and

Whitney's (2001) marker variable test. We used a theoretically unrelated construct ('mobile internet use') to adjust the correlations among the principal constructs in the model. There is little or no theoretical basis that suggests a relationship with the principal constructs. The average correlation among experience of social network site and the principal constructs was $r = 0.053$ (T value = 0.902). Finally, we examined the correlation matrix. There was no highly correlated variable (r > .90), leading to the conclusion that common method bias is not an issue in the both studies.

4.5.3 PLS Analysis

Partial least square (PLS) was used to assess the measurement model and the hypothesized structural model in the two studies. The strength of the measurement model was assessed through examining convergent validity and discriminant validity (Chin 1998; Fornell and Larcker 1981). To evaluate the explanatory power of the structural model, we assessed the R^2 for each dependent variable. The hypotheses of the research model were tested by conducting bootstrapping and then assessing the standardized coefficients and t-statistics for the hypothesized paths in the model.

4.5.3.1 Measurement Model Assessment

Our research model includes all reflective constructs. The measurement model assessment included an examination of convergent and discriminant validity.

Convergent Validity. We examined standardized loadings. All the loadings were 0.91 or higher (see Table 6). The standardized loadings are greater than 0.707, suggesting that the shared variance between each item and its associated construct exceed the error variance (Chin 1998). Thus, all of the indicators were retained for subsequent analysis.

Next, the internal consistency for each block of measures by examining Cronbach's alpha, composite reliability, and average variance extracted (AVE) were evaluated. Values for Cronbach's alpha and composite reliability that exceed 0.70 provide adequate evidence of reliability (Bearden et al. 1993; Yi and Davis 2003). As presented in Table 6, all of the constructs in the measurement model exhibited Cronbach's alpha of 0.91 or higher, and composite reliability of 0.95 or higher. Average variance extracted (AVE) is another indicator of construct

Table 6. Item Loadings and Construct Reliability

Construct	Item	Standardized Loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Anticipated Regret about Contextualized Process Documentation	ARC1 ARC2	0.973 0.974	0.945	0.973	0.948
Anticipated Regret about Generalized Process Documentation	ARG1 ARG2	0.967 0.968	0.932	0.967	0.936
Anticipated Regret about No Process Documentation	ARN1 ARN2	0.993 0.993	0.986	0.993	0.986
Decision to Invest in Process Documentation	DEC1 DEC2 DEC3	0.934 0.925 0.910	0.913	0.945	0.852

validity (Fornell and Larcker 1981). All AVEs are 0.85 or higher, indicating above the accepted threshold of 0.5 (Chin 1998). We concluded that our measures exhibit adequate construct reliability based on the above analyses.

Discriminant Validity. We examined each indicator's loading on its own construct and its cross loading on all other constructs (see Table 7). Table 7 indicates that for each set of measures, the loadings on the intended construct are higher than the cross loadings on other constructs.

Table 7. Loadings and Cross-loadings for the Measurement Model

Construct	Item	1	2	3	4
1. Anticipated Regret about Contextualized Process Documentation	ARC1	**0.973**	-0.173	-0.619	-0.809
	ARC2	**0.974**	-0.154	0.591	-0.793
2. Anticipated Regret about Generalized Process Documentation	ARG1	-0.159	**0.967**	0.141	0.040
	ARG2	-0.167	**0.968**	0.139	0.022
3. Anticipated Regret about No Process Documentation	ARN1	-0.634	-0.140	**0.993**	0.810
	ARN2	-0.600	-0.147	**0.993**	0.791
4. Decision to Invest in Process Documentation	DEC1	-0.810	0.131	0.798	**0.934**
	DEC2	-0.737	-0.006	0.712	**0.925**
	DEC3	-0.725	-0.049	0.717	**0.910**

Table 8. AVEs versus Squares of Correlations between Constructs

Construct	AVE	ARC	ARG	ARN	DEC
Anticipated Regret about Contextualized Process Documentation (ARC)	0.948	-			
Anticipated Regret about Generalized Process Documentation (ARG)	0.936	0.028	-		
Anticipated Regret about No Process Documentation (ARN)	0.986	0.386	0.021	-	
Decision to Invest in Process Documentation (DEC)	0.852	0.676	0.001	0.648	-

Also, we compared the AVE for each construct with the shared variance between all possible pairs of constructs (Fornell and Larcker 1981). Table 8 presents that AVE for each construct is higher than the squared correlation between the construct pairs, indicating that more variance is shared between the latent construct and its block of indicators than with another construct representing a different block of indicators. Thus, the above analyses offer adequate evidence of discriminant validity.

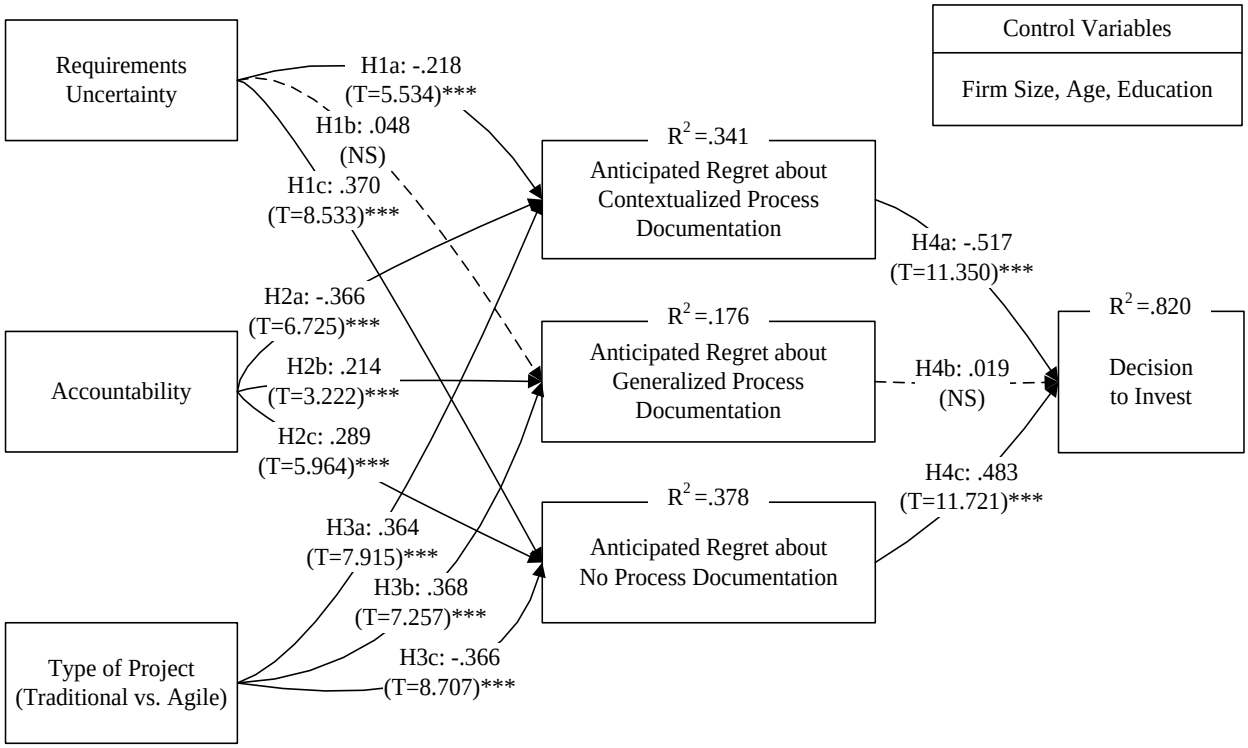
4.5.3.2 Structural Model Assessment

We next examined the structural model (Figure 2). We assessed R^2 for each dependent variable to evaluate the explanatory power of the structural model. The model accounts for 82.0 percent of the variance in decision to invest in process documentation, 34.1 percent of the variance in anticipated regret about contextualized process documentation, 17.6 percent of the variance in anticipated regret about generalized process documentation, and 37.8 percent of the variance in anticipated regret about no process documentation. These R^2 values indicate that overall research model explained process documentation decision making reasonably well. We used a strong manipulation for subjects who are currently involved in making process documentation decisions. Subjects may have guessed the purpose of the manipulation and their expectations may have affected high R^2 (Ome 1979).

We used bootstrapping (1000 resamples) to obtain *t* values for our path coefficients (see Figure 2). Because of the directional nature of the hypotheses, one-tailed tests were used. Requirements uncertainty had a negative effect on anticipated regret about contextualized process documentation (β = -0.218, $p < 0.001$), thus supporting H1a. Requirements uncertainty had a positive effect on anticipated regret about no process documentation (β = 0.370, $p < 0.001$), thus supporting H1c. The effect of requirements uncertainty on anticipated regret about generalized process documentation, however, was not found to be statistically significant. Thus, H1b was not supported.

Accountability had a negative effect on anticipated regret about contextualized process documentation (β = -0.366, $p < 0.001$), thus supporting H2a. Accountability showed a significant positive relationship with anticipated regret about generalized process documentation, hence

Figure 2. Structural Model



Note: NS: path coefficient is not significant; Solid lines indicate significant paths and dashed lines indicate non-significant paths.
* p < .05, ** p < .01, ***p < .001 (one-tailed test)

supporting H2b ($\beta = 0.214$, $p < 0.001$). Also accountability had a positive effect on anticipated regret about no process documentation ($\beta = 0.289$, $p < 0.001$), thus supporting H2c.

The type of project had a positive effect on anticipated regret about contextualized process documentation ($\beta = 0.364$, $p < 0.001$), thus supporting H3a. Type of project showed a significant positive relationship with anticipated regret about generalized process documentation, thus supporting H3b ($\beta = 0.368$, $p < 0.001$). It also had a negative effect on anticipated regret about no process documentation ($\beta = -0.366$, $p < 0.001$), thus supporting H3c.Anticipated regret about contextualized process documentation also had a significant negative effect on decision to invest in process documentation ($\beta = -0.517$, $p < 0.001$), thus supporting H4a. Anticipated regret about

no process documentation had a significant positive effect on decision to invest in process documentation ($\beta = 0.483$, $p < 0.001$), thus supporting H4c. The effect of anticipated regret about generalized process documentation on decision to invest in process documentation, however, was not found to be statistically significant. Thus, H4b was not supported.

4.5.3.3 Control Variables

We did not find any significant relationship between decision to invest in process documentation and controls variables, that is, firm size ($\beta = -0.012$, *NS*), age ($\beta = 0.023$, *NS*), and education ($\beta = 0.023$, *NS*).

4.6 Discussion

We draw upon regret theory and process documentation literature to investigate how requirements uncertainty, accountability, and the type of project (traditional vs. agile) influences anticipated regret about investing in different process documentation options (contextualized, generalized, or no documentation) and how anticipated regret impact decision to invest in process documentation.

This study is the first attempt to investigate the following relationships and contributes to the IS literature in significant ways: first, how requirements uncertainty affects both anticipated regrets about choosing contextualized process documentation and no process documentation; second, how accountability influence anticipated regret about the three types of process documentations; third, how the type of project (traditional or agile) affects anticipated regret about three different types of process documentations; and finally, how anticipated regret about contextualized process documentation and no process documentation influence decision to invest in process documentation. Next we discuss implications for research and practice.

4.6.1 Implications and Contributions to Theory

4.6.1.1 Literature on IS Process Documentation

This study is one of the first attempts at investigating the role of anticipated regret in the context of process documentation decision. Based on an empirical support for our model, this study contributes to this literature in several important ways:

First, understanding the role of anticipated regret in process documentation decision making is a step in the direction urged by Beaudry and Pinsonneault (2010), who emphasize the need for studying antecedents and consequences of emotion in the context of IT projects. In this study, we not only identify the types of anticipated regret involving process documentation decision making, their antecedent, and their consequence, but also the mechanism by which anticipated regret is influenced by reference points. A deeper understanding of anticipated regret helps researchers focus on the potential use of anticipated regret in decision making, the evaluation of anticipated outcomes of alternatives, and behaviors.

Second, our study is the first to theoretically and empirically establish the linkage between anticipated regret about creating contextualized and no process documentations and decision to invest in process documentation. Decision makers who have high anticipated regret about contextualized process documentation are less likely to make decisions to create contextualized process documentation. In contrast, those who have high anticipated regret about no process documentation are more likely to make decision to create either generalized or contextualized process documentation. People are typically regret-aversive and seek to avoid experiencing regret (Reb 2008). However, the bright side of experiencing regret, particularly anticipated regret, is to make people to take vigilant actions for the purpose of minimizing their regret (Zeelenberg and Pieters 2007). In the IT project contexts, as our results suggest, decision makers

who experience anticipated regret about a particular process documentation option pursue a process documentation decision to reduce their anticipated regret.

Third, IS literature (Nidumolu 1995; 1996) has found that requirements uncertainty influences project performance (e.g., process control, product flexibility). But, how requirements uncertainty influences process documentation decision in IT projects has not been investigated. Our findings indicate the significant role of requirements uncertainty that triggers anticipated regret about creating particular process documentation. Our study is the first to establish this relationship theoretically and provide an empirical evidence in IT project management field.

We found that under high requirement uncertainty, decision makers tend to experience less anticipated regret about creating contextualized process documentation, but greater anticipated regret about no documentation. This suggests that decision makers' downward or upward counterfactual thinking on contextualized process documentation or no process documentation options may lead to less anticipated regret about creating contextualized process documentation, but greater anticipated regret about no documentation respectively (Hetts et al. 2000; Roese 1997). However, we could not find a significant positive relationship between requirements uncertainty and anticipated regret about creating generalized process documentation. We speculate that decision makers tend to focus on the two extreme options for process documentation and are unable to estimate the anticipated outcomes for generalized process documentation because what constitutes generalized process documentation may be unclear to them.

Fourth, through the introduction of accountability, this study seeks to provide an understanding of the effect of accountability on anticipated regret about creating various process documentation options. Although psychology literature (Lerner and Tetlock 1999; Quinn and

Schlenker 2002) has identified accountability as a critical fact that influences emotion and decision making by improving goal salience, the importance of accountability remains underdeveloped in the IS field. Our study is the first to theoretically and empirically establish the relationship between accountability and anticipated regret about creating process documentations in IT project management contexts.

The effect of accountability was found to be significant in anticipated regret about creating all three types (contextualized, generalized, and no) of process documentations. The results show that decision makers who have high accountability tend to experience less anticipated regret about creating contextualized process documentation but greater anticipated regret about creating generalized and no process documentations. Consistent with prior literature (Rozelle and Baxter 1981; Tetlock et al. 1989), 'attention effect' of accountability may play a role in motivating decision makers to invest significant efforts on justifying their conducts in creating process documentations. Our results also support prior study (Passyn and Sujan 2006) in that we found a significant relationship between high accountability and anticipate regret experienced by decision makers.

Fifth, our study is also the first to theoretically and empirically establish the relationship between the type of project (traditional vs. agile) and anticipated regret about creating process documentations in IT project management contexts. This study reveals a discrepancy between traditional and agile projects. The results suggest that when compared to traditional projects, decision makers in agile projects are more likely to experience greater anticipated regret about creating contextualized and generalized process documentations, but less anticipated regret about no process documentations. This suggests that in agile projects, decision makers may consider requirements uncertainty to be so high that the changed requirements may be significantly

different from the original requirements thereby making process documentation to be of limited use during maintenance. This leads them to greater anticipated regret about creating contextualized and generalized process documentations but less anticipated regret about no process documentation. The results are consistent with the prior studies (Fernandez and Fernandez 2008; Vinekar et al. 2006) in that decision makes in agile projects are less concerned about creating documentation than in traditional projects.

Finally, we found a significant negative relationship between anticipated regret about contextualized process documentation and decision to invest in process documentation and a significant positive relationship between anticipated regret about no process documentation and decision to invest in process documentation. Our study is also the first attempt to investigate this linkage in IT project management field. Consistent with regret theory (e.g., Inman 2007; Reb 2008; Zeelenberg and Pieters 2007), the results of our study also shows the instrumental behaviors taken by decision makers who experience either anticipated regret about creating contextualized or no process documentation. The anticipated regret leads the decision makers to taking vigilant decision making to minimize their future regret by either making a decision not to create contextualized process documentation or spending more time and efforts to creating process documentation respectively. However, we did find a significant positive relationship between anticipated regret about generalized process documentation and decision to invest in contextualized process documentation. We speculate that the difficulty in estimating the valance of the outcomes for generalized process documentation and uncertainty about what constitutes generalized process documentation may lead to this behavior.

4.6.1.2 Regret Theory

First, prior research has extensively investigated the relationship between responsibility and regret (e.g., Simonson 1992b; Wong and Kwong 2007; Zeelenberg et al. 2000b). But, a study on investigating the role of accountability on anticipated regret and decisions is still in infancy. Thus, this study contributes regret theory by establishing additional evidence on this relationship.

Second, prior studies investigate the role of reference points mostly in *post-choice* valuation in multiple option situations (Boles and Messick 1995; Lin et al. 2006a; Tsiros 1998). Although the literature identifies the potential role of reference points in *pre-choice* valuation in multiple option situations (Zeelenberg and van Dijk 1997), we are not aware of any studies that empirically evaluate this position. We empirically examine the pre-choice valuation of the three alternatives for creating process documentation.

4.6.2 Implications and Contributions to Practice

The study is likely to help practitioners understand how anticipated regret and regret aversion tendency influence decision making. Making anticipated regret more salient may enable practitioners to develop their gut feelings or intuition that can support decision making under uncertainty. The development of experience repositories that document decision made in prior project and their outcomes will help project managers develop better evaluate anticipated outcomes of their decisions when making complex decisions such as process documentation decisions. The study highlights the importance of using appropriate reference points that support the valuation of gains and losses (Kahneman 1992). For anticipated regret to occur, the outcomes of anticipated alternatives can serve as reference point for the comparison of possible alternatives.

4.6.3 Limitations and Future Research

As is the case with all experiments, we need to be cautious when generalizing the results of this study for the following reasons. First, although we strive to control extraneous factors through rigorous experimental process, it is possible that other organizational factors and cognitive processes may influence emotion and hence the process documentation decision. However, our methodological approach is consistent with that taken by other researchers who have investigated the role of regret in decision making (Lankton and Luft 2008; Lin et al. 2006a; Tsiros 1998). Second, this study will measure self-reported behavioral intentions. It is possible that their reaction to the treatment scenarios may differ from an actual reaction. Although there may be some variance between intentions and actual behaviors, findings from the study are likely shed significant light on the phenomenon. Finally, we will also conduct a follow-up study to see whether our research model consistently explains process documentation decision making well.

Appendix 4A: Scenario for the Experiment

You are an IT project manager in your organization. You have just been assigned to manage a software development project that will use **traditional/ plan-driven [agile]** software development methods. The development of the software system is scheduled to commence soon.

Now, you need to decide on the extent to which knowledge about the software development process should be documented in this project. This documentation is intended to be used primarily by project personnel who will maintain the software system to ensure that it meets changing customer needs. You have the following options to choose from in your decision on the extent of process documentation for this project:

- **Extensive / Contextualized process documentation: You will be creating** detailed documentation of **all** issues that are resolved, the context in which these issues are faced, alternative solutions considered, assumptions made, the solutions that are adopted, and the reasons for adopting the chosen solutions.
- **Nominal / Generalized process documentation: You will be creating** documentation of only the issues that are resolved and the solutions that are adopted.
- **No process documentation**

You face several uncertainties while making this decision. If you create nominal or no process documentation, your project may face expensive rework during maintenance because the knowledge about the development process may be lost. On the other hand, if you create extensive documentation, you may find that it was expensive but was found to be unnecessary during maintenance. Your organization does not have any formal procedures to guide you in making this decision. Therefore, you need to make your decision based on your intuition or gut feeling while taking into account the following aspects of the project environment:

a) Based on your prior experience, you believe that the customer requirements identified during maintenance are likely to be **very different [very similar]** from those identified during initial development.

b) Your project **will be [will not be]** subject to a **process audit** i.e. you will be accountable [not accountable] for your decision on the extent of process documentation created in the project.

If you receive a negative review as a result of a process audit, you will face serious consequences for your career in the organization which will significantly affect your compensation.

Appendix 4B: Measurement Items for Constructs

Category	Construct	Items	Sources Informed the Construct
Independent Variable	Requirements uncertainty	*Manipulation check item	(Nidumolu 1995; Nidumolu 1996)
Independent Variable	Accountability	*Manipulation check item	(Lerner and Tetlock 1999), (Quinn and Schlenker 2002), (Zhang and Mittal 2005)
Independent Variable	Type of Project	*The setting was varied as traditional and agile software development projects.	
	Anticipated Regret about Contextualized Process Documentation	When I was evaluating the type of process documentation that my project team should use, I thought if I chose *detailed (contextualized) process documentation*, and in my project appraisal if I got a negative review, (Strongly Disagree/Strongly Agree)(7L) • I would regret spending excessive time and effort in creating detailed documentation that was much more detailed than what was needed during maintenance. (Strongly Disagree/Strongly Agree)(7L) • I would feel sorry for spending excessive time and effort in creating detailed documentation that was much more detailed than what was needed during maintenance.	(Simonson 1992b), (Zeelenberg et al. 1998b), (Tsiros and Mittal 2000), (Wong and Kwong 2007), (Lankton and Luft 2008)
	Anticipated Regret about Generalized Process Documentation	When I was evaluating the type of process documentation that my project team should use, I thought if I chose *basic (generalized) process documentation*, and in my project appraisal if I got a negative review, (Strongly Disagree/Strongly Agree)(7L) • I would regret spending only nominal effort and time in creating documentation that was much less detailed than what was needed during maintenance. (Strongly Disagree/Strongly Agree)(7L) • I would feel sorry for spending only nominal effort and time in creating documentation that was much less detailed than what was needed during maintenance.	
	Anticipated Regret about No Process Documentation	When I was evaluating the type of process documentation that my project team should use, I thought if I chose *no process documentation*, and in my project appraisal if I got a negative review, (Strongly Disagree/Strongly Agree)(7L)	

		• I would regret spending not spending any time and effort in creating documentation that was needed during maintenance. (Strongly Disagree/Strongly Agree)(7L) • I would feel sorry for spending not spending any time and effort in creating documentation that was needed during maintenance.	
Ultimate Dependent Variable	Decision to Invest in Process Documentation	(No Documentation/Basic (generalized) Documentation/ Detailed (contextualized) Documentation)(7L) • What is the extent (level of detail) of process documentation that you will create for this project? (Insignificant Amount of Time/Significant Amount of Time)(7L) • In this project, how much time will you spend in documenting process knowledge? (Insignificant Amount of Effort/Significant Amount of Effort)(7L) • In this project, how much effort will you spend in documenting process knowledge?	(Ungan 2006; Xu and Ramesh 2008)
Control Variable	Firm Size	• How many employees does your organization have?	
	Age	• What is your age?	
	Education	(Undergraduate/ Masters/ PHD) • What is your highest education level?	

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