Control Systems and Incentives as Moderators of the Positive Association between Perceived Environmental Uncertainty and Willingness to Recommend Strategic Change

ABSTRACT

To remain competitive, organizations must change in response to demands in the dynamic environments in which they operate; yet oftentimes they do not change. We examine in an experiment whether middle managers who differ in their perceptions of environmental uncertainty are more or less willing to recommend strategic change when operating under different incentives and control systems. We find the positive relationship between an individual's perception of environmental uncertainty and their willingness to recommend strategic change is generally diminished by combinations of different control systems and incentives. The only combination that increased the manager's willingness to recommend strategic change was when social recognition incentives were combined with control systems operating along strong interpersonal relationships.

This research points out how the two main mechanisms, incentives and controls systems, that senior managers use to influence the actions of others can have important consequences on middle management willingness to recommend strategic change. While preliminary, this research cautions senior managers, operating in shifting environmental conditions, about the types of incentives and control system they implement to direct middle manager attention.

Keywords: control systems; incentives; perceived environmental uncertainty (PEU); strategic change.

INTRODUCTION

There are numerous examples of companies that do not initiate strategic change in the face of environmental threats until firm performance has deteriorated. Examples include Hewlett-Packard, which only initiated a strategic shift after reporting disappointing financial results (Worthen and Sherr 2011), and Research in Motion Ltd. (the maker of Blackberry devices), a once dominate, now struggling smart phone company that only reacted to the introduction of the iPhone after their market share had significantly deteriorated (Cummins 2011). Such reluctance to recommend change may result from the failure of managers to recognize the need for change when the firm is performing well (e.g., Greve 1998, 2003) or insufficient motivation to change (Kressler 2003). To combat this reluctance, organizational factors such as control systems and incentives may be effective since they are often used to direct managerial attention and thereby influence firm strategy (e.g., Simons 1990, 1995; Garg et al. 2003; Kober et al. 2007; Peterson and Luthans 2006). Indeed, prior research has found that control systems influence managers' information search as well as firm-level strategic choice (e.g., Simons 1990, 1995) and incentives are closely tied to managers' motivation to act (e.g., Brüggen and Moers 2007; Peterson and Luthans 2006). To further investigate this issue, we examine whether one individual-level variable – perceived environmental uncertainty (hereafter, "PEU") – and two firm-level variables – control systems and incentives – are effective in overcoming managers' insufficient motivation and/or their inability to recognize that change is needed, thereby increasing their willingness to recommend strategic change (hereafter, "WTRC").

We employ 152 MBA students in a 2x2x2 experiment in which PEU is measured and then dichotomized into two levels (high or low); and control systems (diagnostic or interactive)

and incentives (financial or social recognition) are manipulated between participants. Consistent with prior research (e.g., Simons 1990, 1991, 1995; Tessier and Otley 2012), we manipulate a diagnostic control system as one in which senior management initiates contact with middle management only when the financial system indicates that a performance target has been missed; and we manipulate an interactive control system as one in which senior management maintains an ongoing personal involvement with middle management to establish programs and review monthly financial performance and action plans. Also consistent with prior research (e.g., Peterson and Luthans 2006; Ferreira and Otley 2009), we manipulate financial incentives as a one-time lump sum bonus for performance, and social recognition incentives as senior managers' public acknowledgement, praise, and genuine appreciation of work well done.

Consistent with our expectations, we first document a positive association between PEU and managers' WTRC. We then find that control systems and incentives interact with PEU level to influence managers' WTRC. Specifically, we find that the positive association between PEU and WTRC is greater under an interactive control system as compared to a diagnostic control system. This is consistent with prior research that indicates that diagnostic control systems create a focal point, thereby mitigating some of the influence of PEU by helping managers to understand the impact of environmental change (Agbejule 2005). Also, we find that while social recognition incentives do not alter the positive association between PEU and WTRC, financial incentives weaken this association by increasing (decreasing) the WTRC for those managers low (high) in PEU. This is also consistent with prior research which suggests that while financial incentives (relative to social recognition incentives) can focus managers' attention on important organizational metrics (Brüggen and Moers 2007), they may also restrict a managers' propensity to recommend a strategic change in an effort to protect their immediate or future rewards (e.g.,

Dye 1988; Eisenhardt 1989). Finally, and also consistent with expectations, we find that the positive association between PEU and WTRC is not affected when interactive systems are combined with social recognition incentives but is diminished by all other combinations of control systems and incentives. Regarding the former result, neither interactive systems nor social recognition incentives seem to provide a point of focus for managers to interpret strategic threats, thereby lowering the likelihood that managers will recommend strategic change. Thus, the positive association between PEU and WTRC remains intact. Regarding the latter result, for low PEU managers, both diagnostic systems and financial incentives seem to make low PEU managers behave more like high PEU managers by focusing attention on performance metrics, thereby creating a strategic decision-making framework that increases the likelihood of recommending strategic change. Overall, these results suggest that while the level of PEU influences managers' WTRC, this effect can be enhanced, or muted, by control systems and incentives.

This study extends the literature by providing experimental evidence of the joint effect of firm level factors – control systems and incentives – on individual strategic behavior when individual perception of environmental uncertainty differs and when firm performance has not yet deteriorated. While prior (primarily archival or survey) research considers these factors independently (e.g., Simons 1994; Nyamori et al. 2001; Chenhall 2003; Langfield-Smith 1997, 2006; Henri 2006), no research, to our knowledge, has examined their joint influence on strategic change. Our results suggest that consideration of either of these factors independently is incomplete and potentially misleading. By distinguishing between managers who are lower or higher in PEU, we show that control systems and incentive type can be used to sensitize low, and at times high, PEU managers to impact strategic decision making. In addition, unlike prior

research which has generally focused on strategic change in environments where firm financial performance has typically *already deteriorated* (e.g., Langfield-Smith 1997, 2006; Chenhall 2003; Henri 2006), we examine an environment where firm performance has not deteriorated but where the industry is showing fundamental change. This is important given the tendency of firms to not recognize environmental change until after firm financial performance has occurred (e.g., Greve 1998, 2003). Finally, this study answers the call for research examining both financial and non-financial incentives in conjunction with control systems (Ferreira and Otley 2009) and how control systems are used (Tessier and Otley 2012).

The rest of the paper is organized as follows. In the next section, we review research on the effects of PEU, control systems, and incentives on strategic behavior and develop our hypotheses. Subsequently, we describe our research method and present our results. We conclude by discussing the implications and limitations of our research and offering suggestions for future research.

LITERATURE ANALYSIS AND HYPOTHESES DEVELOPMENT

Perceived Environmental Uncertainty (PEU)

PEU is an individual's perception of uncertainty that results from factors outside the organization (i.e., the external environment) (e.g., Milliken 1987; Tymon et al. 1998). It affects both the attention to, and use of, information (Daft et al. 1988; Sawyerr 1993; Mangaliso 1995; Garg et al. 2003) and influences control system design, use and impact (e.g., Gul and Chia 1994; Fisher 1996; Chenhall 2003; Agbejule 2005). PEU has also been found to be positively associated with environmental scanning (e.g., Mangaliso 1995; Garg et al. 2003) and the identification of organizational improvements (e.g., Sorensen and Stuart 2000; Tripsas and Gavetti 2000; Ahuja and Lampert 2001).

Consistent with Nadkarni and Barr (2008) who highlight the importance of managerial cognition on strategic decisions in (un)certain environments, we suggest that managerial decision making processes underlie these firm level effects. Managers who perceive the environment as low in uncertainty consider the environment relatively stable and understandable and, therefore, are less likely to seek out additional, performance–relevant information (e.g., Gul and Chia 1994; Fisher 1996; Agbejule 2005). In contrast, managers who perceive the environment as high in uncertainty consider the environment unstable and more difficult to understand and, therefore, may seek out and focus on a broader, more comprehensive information set to use in strategic decision making (e.g., Gul and Chia 1994; Agbejule 2005). Thus, high PEU managers have a greater focus on the external environment because they perceive the external environment as more risky.

Applied to the current context, this greater external focus suggests that high PEU managers will be more likely to recognize environmental issues and, therefore, more willing to recommend a strategic change. As for low PEU managers, they will be less likely to recognize environmental issues and, therefore, less willing to recommend a strategic change. Thus, we hypothesize that high (low) PEU managers are more (less) likely to recommend strategic change.

H1: Managers with higher levels of PEU are more likely to recommend strategic change than managers with lower levels of PEU.

Control Systems, Incentives, and PEU

Managerial attention is the first step in the decision making process that leads to action (Cowan 1986; Dutton and Jackson 1987). Attention engages information search important to decision making (Chen and Miller 2007; Ocasio 1997) and is critical to initiating organizational change (Eggers and Kaplan 2009; Kaplan 2008). In short, without attention, there is no action.

We expect PEU to interact with control systems and incentives to influence managerial attention and focus, thereby impacting their strategic decision processes. In the following sections, we develop hypotheses on how differences in PEU interact with both control systems and incentives to influence managers' strategic decision processes.

The PEU X Control Systems Interaction

Control systems are the formalized reports, routines and procedures that managers use to maintain or alter strategic activities, overcome inertia, communicate strategic agenda, ensure organizational attention and focus organizational learning (Simons 1990, 1991, 1999; Ocasio 1997; Ocasio and Joseph 2005). Two general categories of control systems are diagnostic control systems and interactive control systems.[1] Diagnostic control systems are often described as 'management by exception' systems since they compare actual to targeted performance. Performance targets are based upon metrics that are clearly understood within the organization and usually represent key drivers of firm success. Comparative reports concentrate managerial attention, especially when performance goals are missed, and trigger a search for solutions (Greve 1998). Search under diagnostic systems is characterized as deductive, internally focused, and driven from pre-set targets (Daft and Macintosh 1984; Simons 1990, 1991, 1999).

Interactive control systems are characterized by active, personal, regular and ongoing dialogue and engagement by senior management with middle management. In anticipation of this ongoing dialogue, middle managers attend to and dedicate effort toward understanding strategic uncertainties. Through this interactive dialogue, which is inherently inquisitive and

[1] Simons (1995) also includes 'boundary' systems (codes of conduct, proscribed behaviors) and 'belief' systems (values, credos, mission statements) as control systems. We focus on 'interactive' and 'diagnostic' control systems because these systems (unlike boundary and belief systems) provide feedback on strategy efficiency and effectiveness (Langfield- Smith 2006).

information seeking, there is the ongoing establishment of goals, review of progress, and regular follow-up. Interactive control systems generate broad attention and effort that is externally focused and driven by creative search and inductive thinking (Simons 1990, 1991).

Prior research documents the influence of control systems on strategic behavior. For instance, Simons (1994) documents the use of interactive and diagnostic control systems by top managers to alter firm behavior in response to environmental change. In addition, prior research has documented, in a survey of hospital CEOs, a positive relation between the use of interactive control systems and strategic change (Abernethy and Brownell 1999); a relation between control systems and executives' ability to facilitate the acceptance of the need for strategic change (e.g., Ezzamel et al. 2004; Skærbæk and Tryggestad 2010); and a relation between control systems and strategy formulation, implementation and modification in a management buyout context (Bruining et al. 2004). Overall, these studies document the close relationship between control systems and strategic change.

When managers are operating within a diagnostic system, managerial attention is directed toward performance (and often financial) metrics and the external factors that impact these metrics (Simons 1995; Ocasio 1997; Ocasio and Joseph 2005). In this way, the diagnostic system's focus on specific metrics allows environmental issues to be interpreted in relationship to the firm. Therefore, the metrics of the diagnostic system can act as a conduit to understand important environmental issues and to determine whether strategic change is necessary. In addition, with diagnostic control systems, senior managers only become involved with middle managers when a performance metric has been missed. Thus, in an effort to avoid any unwanted attention from senior management, middle managers may want to be more proactive in

recommending strategic change so that they are not held responsible for poor performance in the future.

The focusing effect of the diagnostic system, however, is more likely to affect low PEU managers than high PEU managers. Since high PEU managers are already sensitized to risk in the external environment they are not likely to be further stimulated by such a system. On the other hand, low PEU managers are not externally focused, due to a low perception of environmental risk and, therefore, are more likely to be stimulated by a diagnostic system to notice, focus on and frame environmental issues. Thus, the effect of diagnostic systems should lead to smaller differences in the likelihood of recommending a strategic change of high PEU managers versus low PEU managers. Stated differently, diagnostic systems will increase low PEU managers' WTRC more than that of high PEU managers, thereby weakening the positive association between PEU and WTRC.

Unlike diagnostic systems, interactive systems by design do not focus attention on specific metrics. While interactive systems stimulate search, that search has a tendency to be broad, un-focused, potentially random and driven by inductive thinking (Simons 1995). Given the unfocused search initiated by interactive systems, such systems will generally not influence high and low PEU managers' ability to recognize an environmental issue and, thus, recommend a strategic change. That is, the differences between high and low PEU managers' WTRC will not be altered by interactive systems. This reasoning leads to our second hypothesis, depicted in Figure 1 panel A.

H2: Control systems moderate the positive association between PEU and WTRC such that diagnostic systems will weaken this association but interactive systems will not.

[Insert Figure 1]

The PEU X Incentives Interaction

Incentives are important mechanisms senior managers use to direct the attention and motivation of middle managers (e.g., Ocasio 1997; Stajkovic and Luthans 2001; Ocasio and Joseph 2005; Peterson and Luthans 2006). Incentives can be either financial or social in nature. Financial incentives influence behavior primarily because of their ability to be immediately exchanged for goods or services (Bandura 1986; Stajkovic and Luthans 1997, 2001). While there are many forms of financial incentives, bonuses are commonly used to motivate managers to sustain a high level of effort (Stajkovic and Luthans 2001; Peterson and Luthans 2006) and can influence managers' choice of action (Brüggen and Moers 2007). Social recognition incentives refer to the acknowledgement, attention, praise, approval and genuine appreciation for work well done (Peterson and Luthans 2006) and encompass programs such as employee of the month programs and top sales awards. Social recognition incentives are widely used by practicing managers and have been shown to improve performance, influencing behavior primarily because social recognition can lead to future rewards (Stajkovic and Luthans 2001; Peterson and Luthans 2006). While prior research shows that both financial and social recognition incentives individually impact employee performance, they have an additive impact on employee behavior when both are present (Stajkovic and Luthans 2003), with financial incentives being more powerful (e.g., Peterson and Luthans 2006; Stajkovic and Luthans 2001, 2003).

Applied to the current study, we contend that incentives moderate the positive association between PEU and WTRC such that financial incentives weaken this association as compared to social recognition incentives. Financial incentives direct attention toward monitoring performance metrics and the external factors that may impact and threaten these metrics and the financial rewards associated with these metrics (Simons 1995; Ocasio 1997; Ocasio and Joseph

2005; Brüggen and Moers 2007). While financial incentives may focus managerial attention on specific metrics, managers may be less likely to react and act upon this focus because recommending change may threaten their current or future financial rewards (e.g., Dye 1988; Eisenhardt 1989). Recall that high PEU managers are more likely than low PEU managers to perceive environmental issues. Thus, for high PEU managers who are already attentive to environmental cues, their focus on maintaining their financial rewards may diminish their WTRC. For low PEU managers, this diminishing effect is likely mitigated by financial incentives which stimulate a heightened external focus on environmental cues, thereby increasing low PEU managers' WTRC. Stated differently, financial incentives will diminish the positive association between PEU and WTRC because (a) high PEU managers rewarded with financial incentives will seek to protect their immediate and future financial rewards by not initiating change and (b) low PEU managers will increase their attention to environmental threats, leading to an increase in their WTRC.

Social recognition incentives are not expected to be as powerful as financial incentives in altering the WTRC for high or low PEU managers because, as stated previously, financial incentives are shown to be more powerful in influencing employee behavior (e.g., Peterson and Luthans 2006; Stajkovic and Luthans 2001, 2003). With social recognition incentives, managers are likely to have more difficulty identifying and interpreting the impact of relevant environmental issues because such rewards are often not tied to specific performance metrics. Therefore, social recognition incentives should not impact the differences of high and low PEU managers to recommend change. Based on this reasoning, we hypothesize the following interaction, depicted in Figure 1 panel B:

H3: Incentives moderate the positive association between PEU and WTRC such that financial incentives will weaken this association but social recognition incentives will not.

The PEU X Control Systems X Incentives Interaction

Control systems and incentives are important tools senior managers use, both separately and in combination, to influence manager attention and subsequent action. As hypothesized in H2, diagnostic systems (relative to interactive systems) are likely to generate greater managerial attention and framing capability on environmental issues that threaten relevant performance metrics. This, in turn, will increase low (but not high) PEU managers' ability to recognize the need for change and, in turn, recommend a strategic change. Therefore, when diagnostic systems are combined with either financial or social recognition incentives, the positive association between PEU and WTRC is likely to be diminished due to low PEU managers' increased focus and recognition of a need for strategic change and then the WTRC. Thus overall, under diagnostic systems and either financial or social recognition incentives, the positive association between PEU and WTRC is diminished.

Unlike diagnostic systems, interactive systems do not create focus on specific performance metrics or environmental cues that affect such metrics. When interactive systems are combined with social recognition incentives which also have no focusing effect, the positive association between PEU and WTRC will not be affected. However, when interactive systems are combined with financial incentives, the increased focus on protecting the immediate, or future, financial rewards will diminish the positive association between PEU and WTRC. Taken together, this leads to the following hypothesis, depicted in Figure 1 panel C.

H4: The positive association between PEU and WTRC is moderated by control systems and incentives such that all combinations of control systems and incentives (except for the combination of interactive systems and social recognition incentives) will diminish this association.

METHODOLOGY

Participants

Participants were 152 MBA students from a metropolitan state university. Participants' demographic data is presented in Table 1. As reported in Table 1 panel A, participants had, on average, 8.93 years of professional work experience and 5.92 years of public company work experience. On a seven-point scale where 1 indicates not at all familiar and 7 indicates very familiar, participants indicated that their mean (SD) experience with identifying and providing responses to strategic uncertainties was 5.23 (1.17) and their mean (SD) familiarity with using a planning and budgeting system for identifying areas of strategic focus was 5.32 (1.12). This suggests that participants had an appropriate level of knowledge and experience to perform the experimental task.

[Insert Table 1]

Design and Independent Variables

The experiment is a 2x2x2 design in which *PEU* is a between-participant measured variable that is then dichotomized into two levels (high or low) and control systems and incentives are between participant variables manipulated at two levels: diagnostic or interactive control systems and financial or social recognition incentives, respectively. The first independent variable, PEU, is measured by asking participants to indicate their agreement on a seven-point scale (1 = "strongly disagree" and 7 = "strongly agree") with the following statement: "Atlanta radio market (i.e., the hypothetical business unit described in our experimental case) faces significant environmental uncertainty."[2] These responses are then dichotomized into high and

[2] All participants are given the same information regarding the external environment including some general industry information and some radio market metrics that indicate the market is starting to change.

low PEU based on the median value of the responses.[3]

The second independent variable, control systems, is manipulated between participants at two levels: diagnostic and interactive control systems. In the diagnostic condition, participants are told that senior management relies on monthly reports to monitor the performance of the radio station. When reviewing these reports, senior management focuses on actual to budget results and only becomes involved in the operations of 'Atlanta Radio' when the monthly reports indicate that a performance goal is missed. In the interactive condition, participants are told that senior management maintains ongoing personal involvement with the radio station manager, helps establish new programs and milestones, conducts monthly reviews of progress and action plans and follows up on reports.

The third independent variable, incentives, is manipulated between participants at two levels: financial incentives and social recognition incentives. In both incentive conditions, participants are told that they have a compensation package that includes a base salary and a bonus based upon the firm's return on allocated capital meeting budget. In the financial incentive condition, participants are also told that management recognizes individual performance on a regular basis with additional one-time bonus payments. They are then given an explicit example of such a payment to the technology team and its manager as a reward for their ability to implement the latest version of the budget and reporting software ahead of schedule and under budget. Participants are also told that the careers of employees who are recognized with additional financial rewards often advance more quickly. In the social recognition incentive condition, participants are told that management shows genuine appreciation for work well done and publicly recognizes individual performance on a regular basis. Participants are then given an

[3] There is no significant difference between the four conditions for participants' assessment of environmental uncertainty ($F = 0.56$, p-value = 0.64). Thus, while PEU was measured after participants read the case materials, the manipulations had no discernible impact on participants' responses to the PEU question.

explicit example of such recognition to the technology team and its manager as a reward for their ability to implement the latest version of the budget and reporting software ahead of schedule and under budget. Participants are also told that the careers of employees who are publicly recognized often advance more quickly.

Dependent Variable

The dependent variable is participants' WTRC. Participants indicated their agreement on a seven-point scale (1 = "strongly disagree" and 7 = "strongly agree") with the following statement: As the programming manager, you recommend to the Board of Directors that Atlanta Radio change its programming format to reach a larger share of its target market.

Procedures

Participants were emailed an on-line link to our research instrument. In the experimental scenario, 'Atlanta Radio' is the business-unit, a local radio station that is a subsidiary of a larger entity. Participants are asked to assume the role of the station manager at Atlanta Radio, and are told that the radio station manager is responsible for station profitability and has full authority for station strategy and operations. Participants are informed that the radio station is a subsidiary of a publicly traded company and its strategic objective for the station is long-term profitability which requires maintaining market share. They are told that market share depends on its choice of programming format and that audience music and programming preferences can vary greatly. Participants are then provided information that radio stations generally maintain a single program format throughout the day and that although a radio station may switch to a new daily program format, such changes occur infrequently as they are costly and create revenue uncertainty.

Given this scenario, participants are provided with an overview of the competitive landscape, audience preferences, programming content and performance and market metrics. Finally, participants are told that the parent company is engaged in its strategic planning process and conducting an annual update to its strategic plan. Accordingly, senior management is arranging a presentation for the Board of Directors and has asked the station manager to assess station performance and make a recommendation regarding a program format change. After considering the case information, participants indicated their recommendation regarding a programming format change and then responded to several post-experimental and demographic questions.

RESULTS

Manipulation Checks and Potential Covariates

Two questions were used to examine whether the manipulations of control systems and incentives were successful. The control system manipulation check question asked participants whether the information presented in this case stated that the executive vice president takes an ongoing personal involvement in Atlanta Radio or only becomes personally involved in the operations of a division when the monthly reports indicate that a performance goal is missed. The incentive manipulation check question asked participants whether the executive vice president personally appreciates and publicly recognizes individual performance on a regular basis or whether he recognizes individuals for their performance with significant extra financial payments. Thirty-one of 183 participants who completed the survey were dropped for incorrectly answering either of the two questions or incorrectly answering both questions. The resulting final

sample totaled 152 participants.[4]

To determine whether any background measures should be included as covariates in the hypothesis testing, correlations between the background measures and the dependent measure (i.e., WTRC) were analyzed. As shown in Table 1 panel B, the dependent variable was significantly correlated with three background measures: participants' assessments of whether the financial and operational costs involved in making a radio station format change is worth the reward; personal belief that financial incentives reduce ambiguity and increase role clarity; and personal experience with the level of importance placed on monitoring the strategic plan. Of these three background measures, the first two retained their significance when included in our model (i.e., PEU, control systems, incentives and their interactions) and are thus included in the model (shown in Table 2).

[Insert Table 2]

Tests of Hypotheses

Hypothesis 1 predicts that managers with higher levels of PEU will be more likely to recommend strategic change than those managers with lower levels of PEU. Participants indicated their agreement on a seven-point scale (1 = "strongly disagree" and 7 = "strongly agree") with the following statement: "As the programming manager, you would recommend to the Board of Directors that Atlanta Radio change its programming format to reach a larger share of its target market." As shown in Table 2, ANCOVA results reveal that the main effect of PEU is significant ($p = 0.04$, one-tailed). As expected, managers' level of PEU influences their strategic decisions.

[4] Inclusion of those participants who failed the manipulation checks in our analyses does not substantively change our results or alter the conclusions we draw.

Hypothesis 2 predicts that control systems moderate the positive association between PEU and WTRC such that diagnostic systems will weaken this association but interactive systems will not. As shown in Table 2, ANCOVA results reveal that the interactive effect of PEU and control systems is significant ($p = 0.04$, one-tailed). As expected, the positive association between PEU and WTRC is weaker under diagnostic control systems compared to interactive control systems. The means, as shown in Table 3, show the expected differences. With a diagnostic control system, there is no significant difference ($F = 0.03$, $p = 0.87$, two-tailed) in the participants' mean responses regardless of whether their perception of environmental uncertainty is high (mean = 4.72) or low (mean = 4.78). However, with an interactive control system, there is a significant difference ($F = 4.96$, $p = 0.03$, two-tailed) between the responses of high PEU participants (mean = 4.63) or low PEU participants (mean = 4.00). These results support hypothesis 2 and are depicted in Figure 2, panel A. They suggest that the type of control system alters the influence of PEU level on strategic decisions. Further, we find that for low PEU managers, there is a significant difference ($F = 4.45$, $p = 0.04$, two-tailed) between participants' mean responses in the diagnostic control system condition (mean = 4.78) and those in the interactive control system condition (mean = 4.00). However, we find that for high PEU managers, there is no significant difference ($F = 0.07$, $p = 0.80$, two-tailed) between participants' mean responses in the diagnostic control system condition (mean = 4.72) and those in the interactive control system condition (mean = 4.63). Thus, effectively, diagnostic systems (relative to interactive systems) can help low PEU managers focus more intently on available information that may identify the need for strategic change; in this way, diagnostic systems increase low PEU managers' WTRC. However, for high PEU managers, diagnostic systems

(relative to interactive systems) do not differentially affect their WTRC, since such managers are already sensitized to the risks in the external environment.

[Insert Table 3]

[Insert Figure 2]

In Hypothesis 3, we hypothesize that incentives moderate the positive association between PEU and WTRC such that financial incentives will weaken this association but social recognition incentives will not. As shown in Table 2, ANCOVA results reveal that the interactive effect of PEU and incentives is significant ($p < 0.04$, one-tailed). As expected, financial incentives weaken the positive association between PEU and WTRC but social recognition incentives do not. The means, as shown in Table 3, show the expected differences. With financial incentives, there is no significant difference ($F = 0.005$, $p = 0.94$, two-tailed) in the participants' mean responses regardless of whether their perception of environmental uncertainty is high (mean = 4.38) or low (mean = 4.57). However, with social recognition incentives, there is a significant difference ($F = 8.08$, $p < 0.01$, two-tailed) between the responses of the participants who perceive environmental uncertainty to be high (mean = 5.03) or low (mean = 4.21). These results support Hypothesis 3 and are depicted in Figure 2, panel B. They suggest that using financial incentives mitigates the influence of PEU on strategic decisions. Further, we find that for high PEU managers, there is a marginally significant difference ($F = 3.77$, $p = 0.06$, two-tailed) between participants' mean responses in the financial incentives condition (mean = 4.38) and those in the social recognition incentives condition (mean = 5.03). However, we find that for low PEU managers, there is no significant difference ($F = 0.90$, $p = 0.35$, two-tailed) between participants' mean responses in the financial incentives condition (mean = 4.57) and those in the social recognition incentives condition (mean = 4.21). Thus, effectively, financial incentives

(relative to social recognition incentives) can decrease high PEU managers' WTRC but do not differentially affect that of low PEU managers.

In Hypothesis 4, we predict that the positive association between PEU and WTRC is moderated by control systems and incentives such that all combinations of control systems and incentives (except for the combination of interactive systems and social recognition incentives) will diminish this association. As shown in Table 2, the three-way interaction between PEU, control systems, and incentives is significant ($p < 0.04$, one-tailed). Further, as shown in Table 4, panel A, ANCOVA results reveal that in the low PEU condition, the interactive effect of control systems and incentives is significant ($p < 0.04$, one-tailed). As expected, all other combinations of control systems and incentives (except for interactive systems and social recognition incentives) diminished the positive association between PEU and WTRC. The means, as shown in Table 3, show the expected differences. With an interactive system and social recognition incentives, there is a significant difference ($F = 10.57$, $p = 0.003$, two-tailed) between participants' mean responses when PEU is high (mean = 5.20) or low (mean = 3.58). With an interactive systems and financial incentives, there is not a significant difference ($F = 0.002$, $p = 0.97$, two-tailed) between participants' mean responses when PEU is high (mean = 4.20) or low (mean = 4.59). With a diagnostic systems and social recognition incentives, there is not a significant difference ($F = 0.663$, $p = 0.42$, two-tailed) between participants' mean responses when PEU is high (mean = 4.89) or low (mean = 5.00). With a diagnostic systems and financial incentives, there is not a significant difference ($F = 0.001$, $p = 0.98$, two-tailed) between participants' mean responses when PEU is high (mean = 4.55) or low (mean = 4.56). These results support Hypothesis 4 and are depicted in Figure 2, panel C. They suggest that when low PEU managers are working under a diagnostic control system, the type of incentives in place

really has no influence. However, when low PEU managers are working under an interactive control system, the strategic change decision can be markedly different depending on the type of incentives in place. Further, as shown in Table 4, panel B, ANCOVA results reveal that the interactive effect of control systems and incentives is insignificant ($p = 0.50$, two-tailed). As expected, the difference in the influence of incentives on managers' WTRC is not different when high PEU managers operate within an interactive control system compared to when they operate within a diagnostic control system. Overall, as depicted in Figure 2 panel C, it appears that incentives differentially influence managers' WTRC only under interactive systems and that diagnostic systems eliminate the differential effect of PEU on managers' WTRC.

[Insert Table 4]

DISCUSSION

We document a positive association between PEU level and managers' WTRC and find, consistent with our expectations, that PEU level interacts with the type of control system and incentives to determine managers' WTRC. First, we find that control systems moderate the positive association between PEU and WTRC such that the association is weakened by diagnostic systems compared to interactive systems. Specifically, it appears that diagnostic systems (compared to interactive systems) help low PEU managers focus more intently on available information that may identify the need for strategic change. For high PEU managers, diagnostic systems do not have such effects since such managers are already sensitized to the risks in the external environment.

Second, we find that incentives moderate the positive association between PEU and WTRC such that financial incentives weaken this association but social recognition incentives do

not. Specifically, similar to diagnostic systems, financial incentives appear to standardize the WTRC regardless of the manager's level of PEU. However, the reason underlying this standardization differs. Financial incentives (relative to social recognition incentives) affect the positive association by decreasing high PEU managers' WTRC possibly because of their reluctance to put their financial rewards at risk by initiating change; however, they do not differentially affect that of low PEU managers.

Third and also consistent with expectations, we find that the interactive effect of control systems and incentives on managers' WTRC is dependent on the level of PEU. Specifically, all combinations of control systems and incentives (except for interactive systems and social recognition incentives) diminish the positive association between PEU and WTRC. This is likely because both diagnostic systems and financial incentives increase the focus on performance metrics and thus create a framework to interpret environmental threats, thereby making it more likely to recognize the need for and then recommend strategic change. Overall, these results suggest that while the level of PEU influences managers' WTRC, this effect can be enhanced, or muted, by control systems and incentives.

These findings have both research and business implications. Our findings suggest that the role of PEU and incentives should be considered when evaluating the effectiveness of control systems for strategic decision making. This notion is consistent with Ferreira and Otley (2009) who incorporate a contextual component in their performance management control system framework and propose that reward systems be studied concurrently with control systems. Indeed, the results here suggest that (a) the contextual component should include PEU and (b) incentives and control systems must be simultaneously considered given their interactive effect.

Regarding the impact of our findings on business implications, as environments increase in complexity and organizations become flatter, the ability of firms to adapt to changing environmental conditions is dependent upon the actions of managers (Ocasio 1997; Ocasio and Joseph 2005). Reporting systems and incentives are two critical levers senior managers have to influence managers' behavior. While control systems and incentives are usually established to encourage specific levels of performance, those same systems and incentives influence the ability of managers to recognize environmental issues and recommend action accordingly. The current study demonstrates that there is no single combination of incentives and control systems that will similarly affect all managers. High PEU managers, who appear to already have a heightened sensitivity to environmental changes, are generally less influenced by the attention generating and focusing actions of control systems and incentives. However, there appear to be combinations of control systems and incentives that help low PEU managers attend to the threats in the environment, thereby increasing their WTRC. Thus, given the effect of PEU on incentives and control systems, it behooves senior managers to consider, and possibly influence, managers' PEU level. Further, control systems and incentive structure can be combined in a way that increases low PEU managers' response to strategic threats in the environment without significantly impacting high PEU managers' responses. That is, in order to take advantage of high PEU managers' WTRC as well as positively influencing that of low PEU managers, diagnostic control systems appear most effective. Likewise, financial incentives eliminate the differential effect of PEU on managers' WTRC.

As the first study that examines the impact of control systems, incentives and PEU on manager behavior, this study has several limitations that present opportunities for future research. First, following Milliken (1987) and Tymon et al. (1998), we define PEU as an

individual's perception of uncertainty that results from factors outside the organization. This definition of PEU is most similar to state uncertainty – i.e., lack of understanding about how components of the environment might be changing (Ashill and Jobber 2010). In addition to state uncertainty, Ashill and Jobber (2010) measure PEU as a composite construct made up of subcomponents including effect uncertainty (i.e., lack of understanding of cause and effect relationships) and response uncertainty (i.e., inability to predict likely consequences). Given the effect of PEU documented here, future research should examine how these PEU subcomponents interact with control systems and incentives to impact managers' WTRC.

Second, use of an experimental approach necessitates limiting the information set that is available to participants to minimize participants' time demands and simplifying design choices to maximize the control over and precision of the research questions and analyses. In actual firms, managers would normally have access to a far richer information set compared to our experiment. Future research could examine the effect of control systems and incentives on strategic change in an increasingly rich and realistic information setting.

Third, the participants in our study are graduate business students. While graduate business students have been used to proxy for managers in prior studies (e.g., Kadous and Sedor 2004; Hannan et al. 2006; Kelly 2007, 2010; Jackson 2008) and those employed here have adequate experience (i.e., an average of 8.9 years of professional experience) for the experimental task, the possibility still exists that actual managers in their natural work setting may behave differently. Future research should examine the interaction of control systems, incentives and PEU on actual managers to further develop our understanding of the influence that important system-level structures (such as control systems and incentives) and individual difference variables (such as PEU) have on managers' WTRC.

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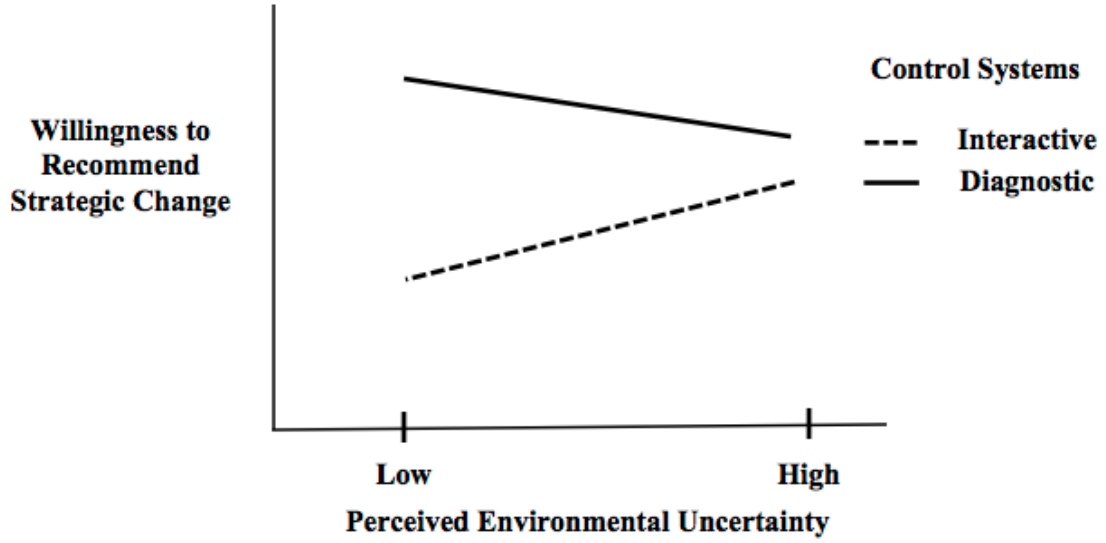
FIGURE 1

Hypotheses

Panel A: Hypothesis 2



Panel B: Hypothesis 3

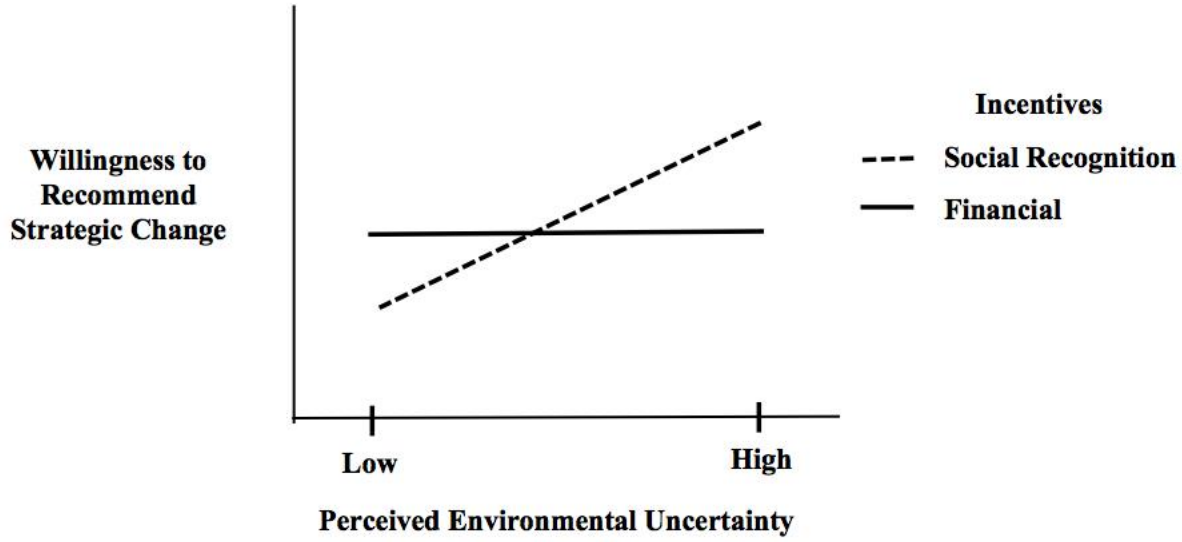


FIGURE 1 (CONTINUED)

Hypotheses

Panel C: Hypothesis 4

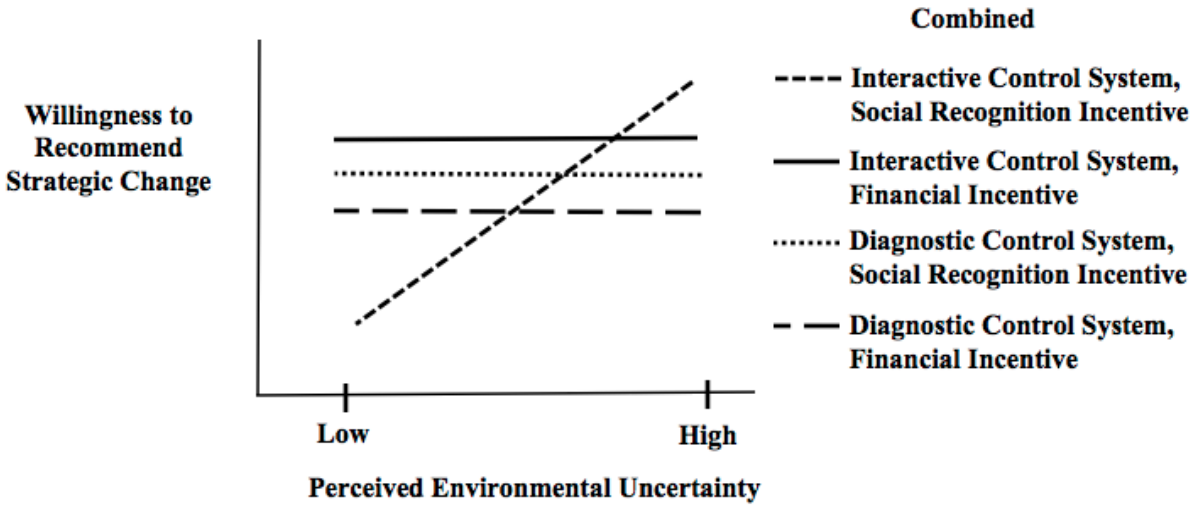
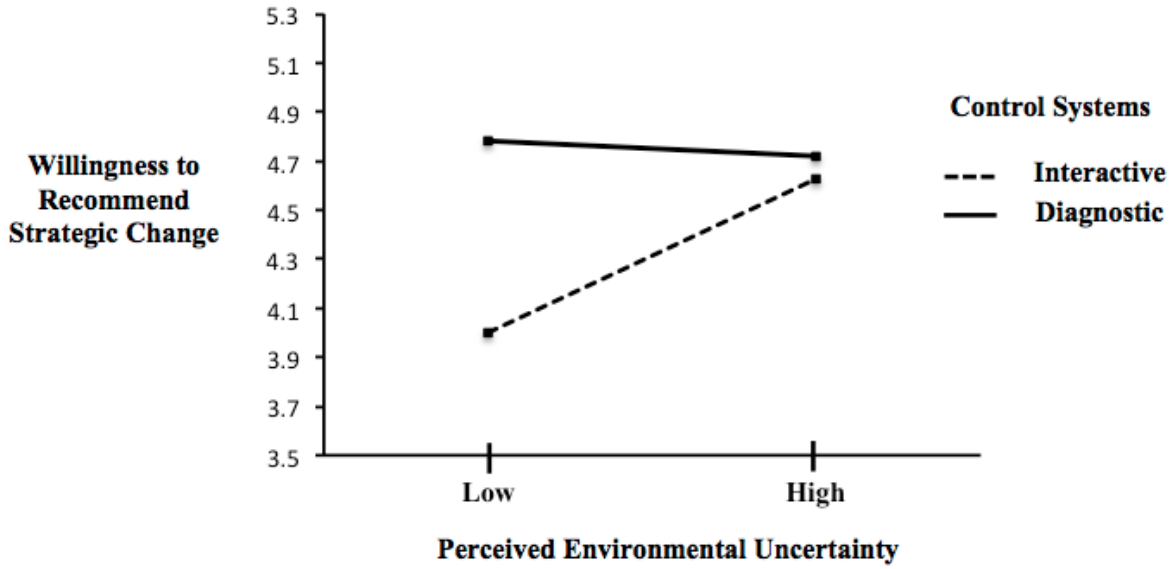


FIGURE 2

Results of Hypotheses Testing

Panel A: Results for Hypothesis 2



Panel B: Results for Hypothesis 3

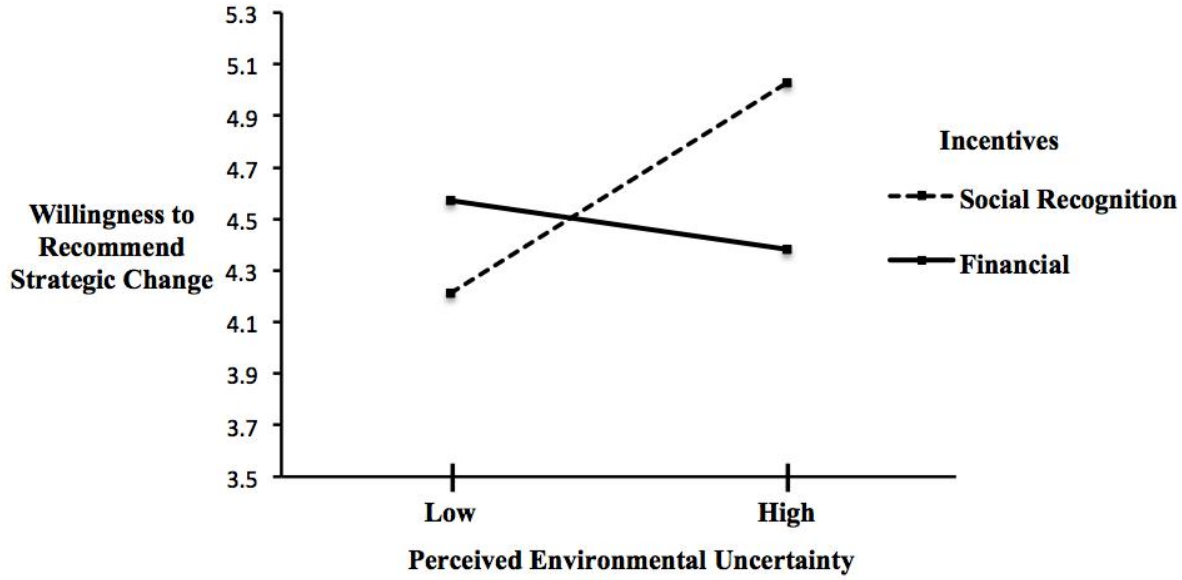


FIGURE 2 (CONTINUED)

Results of Hypotheses Testing

Panel C: Results for Hypothesis 4

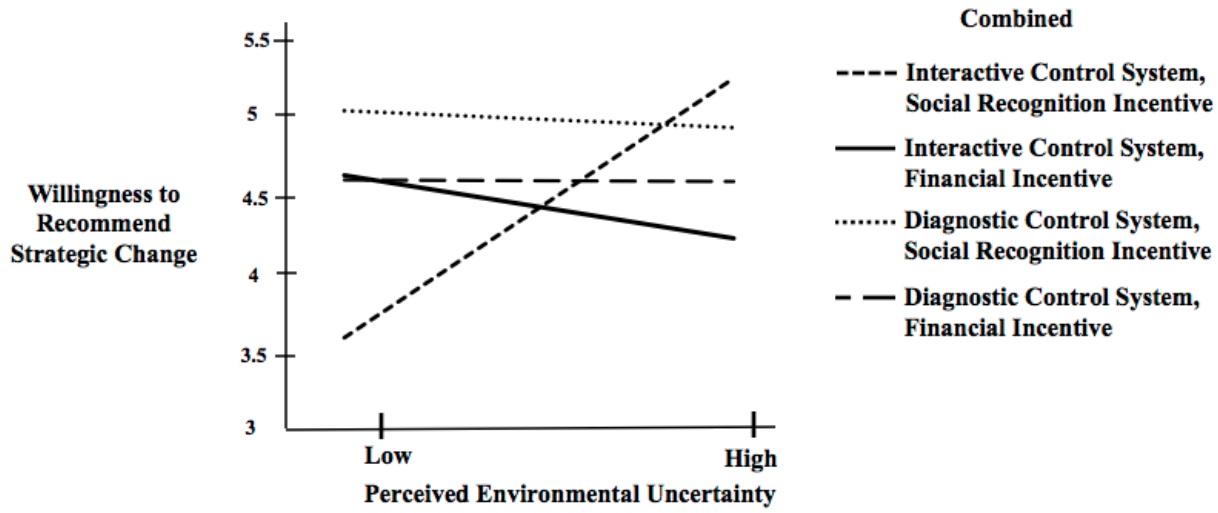


TABLE 1
Descriptive Statistics on Demographic Data and Correlations among Dependent Variable and Background Variables

Panel A: Demographic Data

	N	Percent
Participants with public company experience	98	65
Participants with no public company experience	54	35

	Mean	(SD)
Professional work experience (in years)	8.93	(6.77)
Public company work experience (in years)	5.92	(5.71)
Experience with identifying and providing responses to strategic uncertainties[a]	5.23	(1.17)
Familiarity with using a planning and budgeting system for identifying areas of strategic focus[b]	5.32	(1.12)

Panel B: Significant Correlations among Dependent Variable and Background Variables

	1	2	3	4
1. Willingness to recommend strategic change to programming format[c]				
2. Assessment of cost versus rewards[d]	0.39***			
3. Personal belief that financial incentives reduce ambiguity and increase role clarity[e]	-0.17**	-0.11		
4. Personal experience with the level of importance placed on monitoring the strategic plan[f]	0.13*	0.19**	-0.22***	

* Correlations significant at the 0.10 level (2-tailed)
** Correlations significant at the 0.05 level (2-tailed)
*** Correlations significant at the 0.01 level (2-tailed)

[a] Participants reported their experience with identifying and providing responses to strategic uncertainties on a seven-point scale where 1 = not very familiar and 7 = very familiar.

[b] Participants reported their familiarity with using a planning and budgeting system for identifying areas of strategic focus on a seven-point scale where 1 = not very familiar and 7 = very familiar.

[c] Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree with the following statement: As the programming manager, you recommend to the Board of Directors that Atlanta Radio change its programming format to reach a larger share of its target market.

[d] Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree with the following statement: The financial and operational costs involved in making a radio station format change is worth the potential reward.

[e] Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree with the following statement: In general, financial incentives reduce ambiguity and increase role clarity.

[f] Participants reported their agreement on a seven-point scale where 1 = not very important and 7 = very important with the following statement: Based on your own personal work experience, indicate the level of importance placed in monitoring the strategic plan.

TABLE 2
ANCOVA Results for the Effect of Perceived Environmental Uncertainty (PEU), Control Systems and Incentives on Managers' Willingness to Recommend a Strategic Change[a]

Independent variable	Type III SS	df	F-value	p-value
Perceived environmental uncertainty (PEU)[b] (H1)	6.50	1	3.28	0.04[e]
Control Systems[c]	0.72	1	0.36	0.55
Incentives[d]	0.17	1	0.09	0.77
PEU x Control Systems (H2)	5.83	1	2.94	0.04[e]
Incentives x Control Systems	1.76	1	0.89	0.35
PEU x Incentives (H3)	6.78	1	3.42	<0.04[e]
PEU x Control Systems x Incentives (H4)	6.49	1	3.27	<0.04[e]
Assessment of cost versus rewards[f]	48.36	1	24.40	<0.01
Personal belief that financial incentives reduce ambiguity and increase role clarity[g]	7.35	1	3.71	0.06

[a] Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree with the following statement: As the programming manager, you would recommend to the Board of Directors that Atlanta Radio change its programming format to reach a larger share of its target market.
[b] *PEU* is perceived environmental uncertainty and represents a within-participant independent variable that is measured and dichotomized at two levels (high, low) based on participants' agreement with the following statement: Atlanta radio market faces significant environmental uncertainty. Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree.
[c] Control systems is an independent variable, manipulated at two levels: diagnostic and interactive control system.
[d] Incentives is an independent variable, manipulated at two levels: financial and social recognition incentives.
[e] P-values indicated are one-tailed, given the directional expectations; all other p-values are two-tailed.
[f] Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree with the following statement: The financial and operational costs involved in making a radio station format change is worth the potential reward.
[g] Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree with the following statement: In general, financial incentives reduce ambiguity and increase role clarity.

TABLE 3
Means [SDs] for Managers' Willingness to Recommend a Strategic Change[a]

Panel A: Low PEU[b]

Incentives[d]		Control Systems[c] Diagnostic	Control Systems[c] Interactive	Overall
Financial	Mean	4.56	4.59	4.57
	(SD)	(1.42)	(1.77)	(1.58)
	(n)	(18)	(17)	(35)
Social Recognition	Mean	5.00	3.58	4.21
	(SD)	(1.63)	(1.61)	(1.75)
	(n)	(19)	(24)	(43)
Overall	Mean	4.78	4.00	4.37
	(SD)	(1.53)	(1.73)	(1.68)
	(n)	(37)	(41)	(78)

Panel B: High PEU[b]

Incentives[d]		Control Systems[c] Diagnostic	Control Systems[c] Interactive	Overall
Financial	Mean	4.55	4.20	4.38
	(SD)	(1.73)	(1.40)	(1.56)
	(n)	(20)	(20)	(40)
Social Recognition	Mean	4.89	5.20	5.03
	(SD)	(1.41)	(1.15)	(1.29)
	(n)	(19)	(15)	(34)
Overall	Mean	4.72	4.63	4.68
	(SD)	(1.57)	(1.37)	(1.47)
	(n)	(39)	(35)	(74)

Panel C: Total PEU[b]

Incentives[d]		Control Systems[c] Diagnostic	Control Systems[c] Interactive	Overall
Financial	Mean	4.55	4.38	4.47
	(SD)	(1.57)	(1.57)	(1.56)
	(n)	(38)	(37)	(75)
Social Recognition	Mean	4.95	4.21	4.57
	(SD)	(1.51)	(1.64)	(1.61)
	(n)	(38)	(39)	(77)
Overall	Mean	4.75	4.29	4.52
	(SD)	(1.54)	(1.60)	(1.58)
	(n)	(76)	(76)	(152)

[a] Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree with the following statement: As the programming manager, you would recommend to the Board of Directors that Atlanta Radio change its programming format to reach a larger share of its target market.

[b] PEU is perceived environmental uncertainty and represents a within-participant independent variable that is measured and dichotomized at two levels (high, low) based on participants' agreement with the following statement:

Atlanta radio market faces significant environmental uncertainty. Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree.

[c] Control systems is an independent variable, manipulated at two levels: diagnostic and interactive control system.

[d] Incentives is an independent variable, manipulated at two levels: financial and social recognition incentives.

TABLE 4
ANCOVA Results for Managers' Willingness to Recommend a Strategic Change[a]

Panel A: Low PEU[b]

Independent Variable	Type III SS	df	F-value	p-value
Control Systems[c]	5.38	1	2.55	0.12
Incentives[d]	2.47	1	1.17	0.28
Incentives x Control Systems	7.25	1	3.43	<0.04[e]
Assessment of cost versus rewards[f]	25.15	1	11.91	<0.01
Personal belief that financial incentives reduce ambiguity and increase role clarity[g]	6.82	1	3.23	0.08

Panel B: High PEU[b]

Independent Variable	Type III SS	df	F-value	p-value
Control Systems [c]	0.95	1	0.50	0.48
Incentives[d]	4.37	1	2.31	0.13
Incentives x Control Systems	0.89	1	0.47	0.50
Assessment of cost versus rewards[f]	19.38	1	10.26	<0.01
Personal belief that financial incentives reduce ambiguity and increase role clarity[g]	1.34	1	0.71	0.40

[a] Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree with the following statement: As the programming manager, you would recommend to the Board of Directors that Atlanta Radio change its programming format to reach a larger share of its target market.
[b] PEU is perceived environmental uncertainty and represents a within-participant independent variable that is measured and dichotomized at two levels (high, low) based on participants' agreement with the following statement: Atlanta radio market faces significant environmental uncertainty. Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree.
[c] Control systems is an independent variable, manipulated at two levels: diagnostic and interactive control system.
[d] Incentives is an independent variable, manipulated at two levels: financial and social recognition incentives.
[e] P-value indicated is one-tailed, given the directional expectation; all other p-values are two-tailed.
[f] Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree with the following statement: The financial and operational costs involved in making a radio station format change is worth the potential reward.
[g] Participants reported their agreement on a seven-point scale where 1 = strongly disagree and 7 = strongly agree with the following statement: In general, financial incentives reduce ambiguity and increase role clarity.