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The Effects of Non-Financial Performance Measures in a
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Elizabeth Connors

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THE EFFECTS OF NON-FINANCIAL
PERFORMANCE MEASURES IN A BONUS CONTRACT

By

Elizabeth Connors

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

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2004

This study examines the effects of incentives placed on quality and financial and non-financial sources and through the plastics industries are shown to show a positive association between incentives placed on internal quality and financial performance. There is also evidence that bonus contracts, financial performance bonus contracts.

The effects of incentives are also examined. For quality and environmental belief they are experienced predictions, test results.

ABSTRACT

THE EFFECTS OF NON-FINANCIAL PERFORMANCE MEASURES IN A BONUS CONTRACT

By

Elizabeth Connors

This study examines the association between the association between the weight placed on quality and environmental performance measures in managers' bonus contracts and financial and non-financial performance. Data collected from publicly available sources and through mail surveys to plant managers in the chemical, paper, furniture and plastics industries are used to examine several hypotheses. The results reported here show a positive association between external quality performance levels and the weight placed on internal quality performance and external quality performance in the bonus contracts. There is also a positive association between external quality performance and financial performance when weight is placed on external quality performance in the bonus contracts.

The effects of three additional factors on financial and non-financial performance are also examined. First, I examine whether the association between bonus weight and quality and environmental performance will be more positive when managers report the belief they are experiencing increasing marginal returns to investment. Contrary to predictions, test results suggest a negative (no) association between external quality

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(environmental) performance levels and high internal and external performance weight in bonus contracts when managers perceive increasing marginal returns to investment.

Second, I examine whether the association between bonus weight and quality and environmental performance is more positive when managers report having capital budgeting decision rights for these measures. The tests reported here do not support this relationship. Finally, I examine whether the association between financial performance and quality and environmental performance is more positive when reliable quality and environmental cost information is available. The results suggest that a negative association between environmental performance and financial performance when environmental cost information is available. Also, the results show a positive association between bonus weight on environmental performance and financial performance.

This study raises several interesting questions regarding the relationship between internal and external quality performance and the relationship between the design of bonus contracts and the design of annual review contracts for managers.

This dissertation is dedicated to my parents, Beverly and John Connors and to my sister, Anne.

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Jacobs and Dr. Fran

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I am also in debt to my children, Ian and Tristan, who have taken a back seat for a very long time.

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CHAPTER 1

INTRODUCTION

Multi-action principal-agent theory suggests that, under certain circumstances, non-financial performance measures can be used in an agent's bonus contract to induce an improvement of both financial and non-financial performance. This study examines the association between the weight placed on two specific non-financial performance measures, quality and environmental performance, in managers' bonus contracts and financial and non-financial performance. In addition, the study assesses the relation between three institutional and process-related variables on financial and non-financial performance. These variables are the level of decreasing returns to quality and environmental investment experienced by the sample facilities, the amount of reliable quality and environmental cost information available, and the level of control assigned to the manager over quality and environmental capital investment decisions.

In general, previous studies on the value of the use of additional performance measures in incentive contracts have been focused on determining whether certain non-financial performance measures are leading indicators of financial performance. Another related stream of literature investigates whether the use of incentive based or non-traditional reward systems are associated with either current non-financial or financial performance. This study extends the second stream of literature by testing the association between the weights on non-financial measures in a bonus plan and both financial and non-financial performance. It also attempts to explicitly incorporate the effects of non-

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linearity on the relation between financial and non-financial performance. Previous studies have documented that these non-linear relations do appear to exist, but do not specifically control for them. In addition, the study incorporates two contingency factors, information and decision rights, that are hypothesized to have a positive association with performance.

Survey data collected from plant managers in four industries provide information regarding the weights assigned to several financial and non-financial measures in their annual review and their bonus contracts for three years. Interestingly, on average more weight was placed on non-financial measures in the managers' annual review contracts than in their bonus contracts. This finding highlights the complexity of evaluating the effects of incentive contracts on performance. The survey data also provided information relating to the institutional and process-related variables of interest and on quality and financial performance. Environmental performance was measured using publicly available information.

The results indicate a positive association between the weight placed on quality measures in the bonus contracts and external quality performance. The data also suggest a complex relationship between internal and external quality performance and between quality incentives and performance. Bonus weight on environmental performance is positively associated with financial performance levels. Also, external quality performance is positively associated with financial performance when weight is placed on external quality performance in the bonus contract. Finally, the associations between performance and experiencing decreasing returns to investment, information and decision rights are mixed or non-existent, suggesting possible variable measurement issues or

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complexities that are not well understood and providing the basis for future research questions.

The remainder of this paper is structured as follows: Chapter 2 presents the literature review, Chapter 3 presents and discusses the hypotheses, Chapter 4 presents the research methods and results, Chapter 5 concludes with a discussion of the results and limitations of the study as well as directions for further research.

CHAPTER 2

LITERATURE REVIEW

Performance Measures in Incentive Contracts

Corporate managers are responsible for many aspects of firm performance. Some of the decisions that they make and actions that they take affect current profitability directly. Examples of such actions often relate to cost reductions such as downsizing, supplier changes, and product and process changes. Other decisions made and actions taken by managers may only increase firm profits in the future, sometimes at the expense of current profitability. Increased customer satisfaction, quality improvements, pollution reduction, employee training, and investment in information technology are examples of such actions. Management compensation contracts that reward performance measured solely as short-term profitability may discourage managers from making decisions and taking actions that improve profitability over a longer time horizon.

Firms are increasingly incorporating non-financial performance measures in management reward systems in order to focus attention towards long-term strategic corporate goals and short-term customer satisfaction, particularly when achievement of those goals is expected to be at the expense of near-term financial performance (Ittner et al. 1994). Accordingly, there has been increasing interest in the performance consequences of including non-financial performance measures in executive compensation plans as well as in the management of competing goals (Ittner and Larcker 1998).

The current study examines the financial and non-financial performance effects of incorporating non-financial performance measures in bonus contracts of plant managers.

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Multi-action Principles

Agency models

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Economic theory suggests that inclusion of non-financial performance measures that have certain characteristics in the incentive contracts of managers should result in the increase of performance on both the financial and non-financial measures. The improvement of non-financial performance is important because this performance is expected to be a leading indicator of financial performance. This study also examines the direct and indirect effects of three institutional and process-related variables on financial and non-financial performance. These variables are the perception of experiencing increasing marginal returns to quality and environmental investment, the amount of reliable cost information available and the control that a particular manager has over capital investment decisions that affect his or her plant.

There is an emerging and diverse literature stream relating to the use and consequences of the use of non-financial performance measures in compensation contracts. This chapter begins by reviewing the agency theory and supporting empirical studies relating to the value of non-financial measures in compensation contracts, the determinants of the choice of such measures and the factors that affect the weights on the measures. Explanations for multi-action agency model failure are presented. A discussion of the choice of non-financial measures to be included in this study follows. A review of the literature relating to the institutional factors included in the model is presented, followed by a discussion of the contributions of this study to the literature.

Multi-action Principal-Agent Theory

Agency models address the situation in which there is an incentive problem because the agent's (manager's) actions are unobservable to the principal (owner). In single action models the agent is typically risk-averse and effort-averse and the challenge

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for the principal is to create a contract that causes the agent to take the action that the principal desires while limiting the risk imposed on the agent. Assumption of risk is costly to the agent and he/she will require additional compensation in order to assume such risk (Lambert 2001).

Multi-action contracting models address the fact that managers are typically responsible for a set of actions. An incentive contract that relies on a single, imperfect measure of performance will not provide the principal with information regarding all of the important actions that are taken, or not taken, by the agent. In general, the multi-action models suggest that under certain circumstances, additional performance measures may be added to an incentive contract to reduce welfare loss by making the agent's actions more congruent with the principal's preferences and by reducing the risk imposed by the contract on the agent.

These multi-action contracting models and corresponding empirical work can be separated into three categories: those that address the value of additional performance measures in incentive contracts, those that address the choice of performance measures in incentive contracts, and those that address the choice of weights associated with performance measures in incentive contracts.

The Value of Additional Performance Measures in Incentive Contracts

Feltham and Xie (1994) acknowledged the fact that performance measures can be imperfect reflections of economic consequences of manager's actions. A performance measure may be incongruent where the degree of congruity is defined as the relationship between the action of the agent and the objectives of the principal. A performance measure can also be noisy, where noise is the effect of random, uncontrollable events on

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the measure. The use of additional performance measures in an incentive contract can influence the agent's actions to be more congruent with the goals of the principal and/or can reduce the noise in the overall contract, thereby reducing the risk to the agent.

Feltham and Xie (1994) argued that one setting in which additional measures should provide incremental value is in a contract in which a myopic measure is used. A myopic measure is one that does not fully reflect the economic consequences of an agent's actions. Financial measures of performance such as accounting earnings or ROA have been criticized as being myopic because they are focused on short-run performance and penalize current investments in long-term profitability. Suppose, for example, a principal rewards an agent solely on the basis of current earnings, but customer satisfaction influences future earnings. If the agency relation ends before customer satisfaction generates additional profits, the agent will focus all of his or her efforts on improving current earnings and none on customer satisfaction. The Feltham and Xie (1994) model suggests that the addition of a customer satisfaction measure to this contract could add value (reduce welfare loss) by encouraging the manager to focus his or her actions on both financial and customer service performance, thereby improving current and future financial performance. The addition of this non-financial performance measure may also reduce compensation risk to the agent given the appropriate weights on the measures and their variance-covariance properties (for an example see Feltham and Xie 1994, 438-440).

Results of empirical studies that attempt to identify the effect of the use of non-financial measures in reward systems on financial and non-financial performance are mixed (Banker et al., 2000; Campbell and Soderstrom, 1998; Ittner and Larcker, 1995).

Banker et al. (2000) investigated whether some non-financial performance measures were leading indicators of future financial performance and whether the introduction of an incentive plan that included both financial and non-financial measures was followed by an increase in performance on both measures. Their model acknowledged that incentive plans that include non-financial performance measures can improve financial performance directly or indirectly through improved non-financial performance. This study benefited from access to a long time-series of performance data pre- and post-introduction of the incentive plan as well as information regarding the weights attached to the measures in the plan.

The authors found that customer satisfaction measures were significantly associated with future financial performance and that both financial and non-financial performance improved after the introduction of a management incentive plan that included non-financial performance measures. Interestingly, the improvements on both financial and non-financial measures were achieved with very little increase in incentive intensity. That is, the maximum bonus eligibility as a percentage of base salary remained unchanged for most managers.

Campbell and Soderstrom (1998) found that there is a positive association between the inclusion of an environmental performance component in CEO compensation and financial and environmental performance for a subset of S&P 500 firms. They also found that the incorporation of environmental performance in CEO compensation was associated with a lower risk premium in compensation.

Unfortunately, the data source used for this study does not specifically determine whether the level of management reported is indeed the CEO or if it is some lower level such as

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the management of the environmental and legal department. The data also does not reveal the weights applied to environmental performance in the compensation contracts of interest.

Ittner and Larcker (1995) found that a greater use of nontraditional information and reward systems by firms with less extensive formal TQM practices is associated with better performance as measured by return on assets and product quality. Yet, they did not find the expected result that the interaction of extensive use of TQM and nontraditional information and reward systems was associated with high financial performance. The authors measured the reported importance of non-financial measure relative to financial measures in compensation contracts, but were not able to determine what measures were used and to what extent.

Sim and Killough (1998) studied the relationship between the focus on non-financial performance measures and goals and non-financial performance. They investigated whether there were synergies between Total Quality Management (TQM) and Just-in-Time (JIT) management practices, performance goals, and incentive-based compensation plans that affect customer and quality performance. They found that there were indeed synergies with the combination of high levels of TQM and JIT, incentive compensation and extensive performance goals having the highest effect on the non-financial performance measures. This study does not directly relate to the model presented by Feltham and Xie (1994) because Sim and Killough (1998) did not know whether the incentive pay contracts were based on the performance measures of interest. However, the complementary aspects of incentive compensation and non-financial performance highlighted in their study have implications for the current research.

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Using survey data, Perera et al. (1997) tested whether there is an association between the use of customer-focused manufacturing strategy and the use of non-financial measures in performance measurement systems. They found the hypothesized positive association. They also tested whether there was an association between the use of non-financial measures in performance measurement systems and self-reported financial performance. They did not find this association. Unfortunately, the authors were unable to determine if the non-financial measures used were actually incorporated into an incentive compensation system. They also did not test for an association between the use of such measures and non-financial performance.

Empirical studies that test for an association between customer satisfaction and future financial performance also yield equivocal results. Foster and Gupta (1998) attempted to determine if customer satisfaction performance was a leading indicator of financial performance in a wholesale beverage company. Their results varied depending on the questions included in the customer satisfaction measure and depending on whether they were testing a levels model or a percentage change model. Their results appear to indicate diminishing returns to customer satisfaction performance at high levels of performance.

Ittner and Larcker (1998) also studied the effect of customer satisfaction on future financial performance using three distinct samples of data; specifically, the customer level, the business-unit level and the firm level. They found that customer satisfaction measures were associated with future customer purchase behavior, growth in the number of customers and financial performance. However, they found that these associations move through stages and appear to diminish at high satisfaction levels.

The empirical studies discussed above investigated the relationship between the use of non-financial measures in reward systems and non-financial and financial performance. The current study is an extension of this stream of literature. It attempts to examine the same relationships using the weights placed on non-financial performance measures in bonus contracts and incorporating other institutional and process related variables that are expected to have an impact on those relationships.

The Choice of Performance Measures in Incentive Contracts

Feltham and Xie (1994) suggested that the addition of a performance measure to an incentive contract adds value if the measure is sufficiently congruent with the principal's goals, sensitive on the agent's actions, and is not too noisy. A noisy measure imposes additional risk to the agent for which he or she will require compensation. This additional cost may outweigh the benefit of the additional congruent measure. Therefore, the precision of the measure (the inverse of the variance) is important to the choice of performance measure and the weight (incentive intensity) assigned to it in a linear contract.

Dikolli and Kulp (2002) addressed the fact that performance measures may be interrelated and an agent's efforts may be interrelated. They showed that these substitute or complementary relationships between both performance measures and agent efforts affect the choice of, weight and use of measures in compensation contracts. This result is independent of the sensitivities (the mean change in the measure due to an agent action), precision, or congruity of the measures.

Bushman et al. (1995) presented a model in which interdependencies within a firm affected the type of performance measures chosen for compensation contracts of

individual managers. Specifically, they showed that the use of aggregate measure rather than more localized measures of performance increases with intrafirm interdependencies. This is a single action model, however. In a multi-action model, the weights applied to aggregate and localized measures depend on the type of interdependencies (Lambert 2001).

Bushman et al. (1995) examined their theoretical model by investigating the association between firm interdependencies and the use of aggregate performance measures in the bonus contracts and long-term compensation contracts of division and group CEO's of a sample of 246 public firms. They found that the use of aggregate performance measures in these contracts is positively associated with interindustry segment sales and intergeographic segment sales (proxies for interdependencies) and negatively associated with product-line diversification and geographic diversification (proxies for divisional independence).

Ittner and Larcker (2002) extended Banker et al. (1995) by providing an empirical test of the determinants of the choice of specific performance measures in worker compensation plans. They found that the factors that influence the choice of specific measures in the contracts vary and are complex. For example, they found that plans that supported a continuous improvement strategy made more use of both financial and non-financial performance measures such as volume, quality and attendance, but not safety. Plans that supported innovation-oriented strategies were negatively associated with the use of volume, safety and attendance measures.

Ittner and Larcker (2002) also found that regulation affected the choice of performance measures in worker contracts. In addition, they found that the reasons for

adoption of a certain compensation plan, such as organizational change, affected performance measure choices as well as did unionization and management participation in plan design. The authors concluded that studies that aggregate performance measures into classifications such as financial and non-financial for the purpose of studying performance measure choice should acknowledge these complexities when making inferences from results.

The Factors That Affect the Weights on Performance Measures in Incentive Contracts

The final set of studies relating to contracting in a multi-action setting investigate the determinants of the appropriate relative weights to be applied to performance measures in a linear contract. Banker and Datar (1989) constructed a model in which the weights assigned to each measure were a proportional to sensitivity/precision.

Empirically, Core et al. (2002) found that the relative weight on stock price and non-stock price measures in total CEO compensation was an increasing function of the relative variances, while the relative weights in cash compensation were a decreasing function of the relative variances. They suggest that their findings may differ from economic theory because the incentives from cash compensation, as opposed to salary and stock option grants for example, may have a stronger effect on motivation than the incentives from non-cash compensation. However, the authors admit, this explanation seems counterintuitive because the equity portion of the compensation would impose costly risk to the CEO without observed incentive benefits.

Datar et al. (2001) extended the work of Feltham and Xie (1994) by investigating the determinants of the optimal weights on performance measures in a multi-action framework. Their model indicated that the principal chooses the weights in order to

maximize the congruity between the performance measures and the principal's payoff. The weights are also affected by the interactions between the measures in the contract. Datar et al. (2001) also showed that there is a cost/benefit tradeoff between the congruity of the contract and the (costly) risk imposed on the agent. Increased sensitivity of the measure to the actions of the agent does not necessarily lead to increased weight on the measure in a contract due to congruity and variance effects as well as performance measure interactions. The current study does not specifically address these effects or interactions. However, the results of the study may be affected by these variables which are, unfortunately, difficult to identify and measure.

Ittner et al. (1997b) identified factors that affect the weight placed on financial and non-financial measures in formula-based CEO annual bonus contracts. They found that the weight of non-financial measures increased with the level of regulation, the extent to which the firm followed an innovation-oriented strategy, adoption of strategic quality initiatives and the noise in the financial performance measures. The authors identified these particular institutional factors to examine because they represent situations in which non-financial performance measures are expected to be relatively more informative about managerial actions. Due to the constraints that are inherent in the use of public data to generate information relating to the compensation contracts of CEOs, the (Ittner et al. (1997b) study was unable to address the question of the determinants of the weights in the contracts on specific non-financial performance measures.

The model in this study tests for positive associations between the weight placed on two specific non-financial performance measures in the bonus contracts of plant

managers and concurrent financial and non-financial performance. As such, this model relates most closely to the multi-action agency theory literature stream regarding the value of certain measures in performance contracts. This study does not attempt to identify the factors that affected the choice of these measures for the sample of plants, nor the choice of weights on those measures in the bonus contracts. However, a discussion of those two particular multi-agent literature streams is instructive because it illustrates the complexity of the factors involved in creating an incentive contract and may provide explanations for weak or nonexistent observed associations between the use of performance measures and performance in practice.

Explanations for Multi-action Agency Model Failure

Recall that the Feltham and Xie (1994) model suggests that the appropriate use of additional performance measures in an incentive contract will cause the actions of a manager to be more congruent with the goals of the firm. Specifically, the use of the measures will improve concurrent performance on financial and non-financial measures where there is an assumption that the non-financial performance is a leading indicator of financial performance. There are several reasons why finding empirical evidence of these relationships using survey data and archival data may be difficult.

In order to encourage improvement on both financial and non-financial performance the addition of non-financial measures in an incentive contract must reduce the overall risk to the manager, alternatively, the incentive intensity of the contract must increase (Feltham and Xie, 1994). Otherwise, the manager may simply shift effort away from actions that affect financial performance towards affecting non-financial performance, thereby reducing current financial performance assuming no

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complementarities. In practice, firms may underestimate the risk imposed on the manager by multi-measure performance contracts or may underestimate the future benefits of current non-financial performance and accordingly under-provide financial incentives to the manager. In either event, a negative effect on financial and/or non-financial performance may occur.

Dikolli and Kulp (2002) suggested that interactions between the agent's efforts and the interactions between performance measures should be taken into account in the design of incentive contracts. In practice, these interactions could be difficult to identify and measure and these difficulties could result in suboptimal contract design. For example, process changes adopted in order to reduce costs may simultaneously affect product quality, pollution emissions and safety measures. Further, it is not clear that firms choose the weights on performance measures in accordance with agency theory because compensation contracts are complex and include both cash and non-cash incentive components (Core et al., 2002).

As previously discussed, tests of the value of non-financial performance measures as leading indicators of financial performance exhibit mixed results. Despite the claims of quality and customer satisfaction improvement proponents, the appropriate functional form of this suggested relationship has not been determined (Ittner and Larcker, 1998). This lack of a predictable relationship could cause firms to under(over)-estimate the future financial benefits of improved non-financial performance and therefore under(over)-provide incentives to managers.

It is also important to understand that multi-action agency models rely on the assumption of linear contracts. Even in cases when this assumption holds, there may be



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judgement and discretion used in compensation decisions that essentially make the contracts non-linear (Lambert, 2001). These adjustments to compensation may not be observable in available data but may have an impact on the relationship between performance measure use and performance. Indeed, it is not clear that formula-based contracts are the best contract choice for all firms. Gibbs et al. (2002) pointed out that firms may avoid the use of formula based contracts because of their incompleteness, inflexibility and because of the risk associated with target achievability. Using data collected from department managers in automobile dealerships, they showed some evidence that subjective bonuses are used to complement perceived weaknesses in bonus contracts based on quantitative performance measures.

There is also an argument that the use of financial rewards in certain circumstances can be counterproductive. For example, Crosby and Deming warned against the use of financial rewards for quality performance because such a system could adversely affect the teamwork required to successfully implement a quality program (Crosby, 1996). Instead, public recognition was suggested as a sufficient reward for outstanding performance.

Finally, even though financial rewards may be used in a linear compensation contract to elicit desired behavior from managers, other aspects of rewards evident in organizations may be more important to the manager. Raises, promotional opportunities and reputation could affect the choices that managers make and could be an influential factor in the relationship between the use of certain performance measures in contracts and the resulting performance effects.

Quality and Environmental Performance Measures in Management Incentive Contracts

The non-financial performance measures of interest in the model proposed in this study are quality performance and *voluntary* pollution reduction performance. These two measures are considered to be appropriate for this study for two reasons. First, researchers disagree regarding whether the use of financial incentives and rewards will encourage quality improvement and pollution reduction. Crosby and Deming argue that financial rewards are counterproductive in a Total Quality Management (TQM) setting (Crosby, 1996). On the other hand, Juran (1989) argues that recognition and rewards through salary increases, bonuses and promotion are essential to engender motivation for quality performance. Wruck and Jensen (1994) criticize the arguments of Deming and Crosby as being too simplistic. They suggest that properly designed and implemented financial reward systems are essential to TQM success.

Similar differences are expressed in the environmental performance literature. Makower (1994) is ambiguous in his discussion of the value of financial incentives and rewards for Environmental Management Systems (EMS) and towards pollution reduction goals. He provides examples of financial reward use and the use of more intangible rewards such as public recognition in various companies, but does not suggest that either type of rewards are preferable. However, Epstein (1996) emphatically argues that stated corporate environmental goals must be reflected in the performance measurement used for salary, bonus and promotion purposes. He specifically argues that the use of solely financial performance goals in the evaluation of performance for compensation purposes undermines stated goals of pollution reduction.



These disagreements raise interesting issues regarding the performance effects of including these performance variables in bonus contracts. TQM and EMS performance measures have also been chosen for this study because of striking similarities between TQM and EMS (Klassen and McLaughlin, 1996). The fundamental goal of each is to reduce waste. Both TQM and EMS pursue long-term goals that integrate either product quality or pollution reduction in all phases of decision making. Such phases include product and process design, supplier evaluation, marketing, product delivery and use, customer service and post-consumer product disposition (Hunt and Auster, 1990). The theories of EMS are heavily drawn from the theories of TQM and the programs may interact (Epstein, 1996). Both TQM systems and EMS can be internationally certified under the ISO 9000 and ISO 14000 standards, respectively.

Second, quality performance is arguably a leading indicator of financial performance (Banker et al., 2000; Foster and Gupta, 1998; Ittner and Larcker, 1998; Ittner and Larcker, 1995). The TQM literature proposes that the benefits from investments in product quality result from internal cost reductions and increased revenues from improved customer satisfaction. Increased product quality should lead to lower warranty costs and greater production efficiencies. Direct productivity benefits result from lower costs of scrap, rework, inspection, and repair. Indirect productivity benefits result from lower downtime due to fewer defects in purchases from suppliers and production, lower buffer inventories, higher machine utilization, and lower schedule changes and congestion (Ittner, 1994).

Increased customer satisfaction should reduce marketing costs and increase revenues through higher customer retention and loyalty, higher profit margins, and lower

vulnerability to competitive threats (Ittner and Larcker, 1996). The logic of this model is quite compelling. So much so that, since the mid-1980's, most American companies have initiated some type of quality program (Ittner and Larcker, 1996). It is expected that the benefits of quality investments will be recognized over time (Banker et al., 2000) and may not be captured entirely by current financial performance measures. Therefore, quality performance appears to exhibit characteristics that should make it appropriate for inclusion in a model that tests the effects of non-financial performance measures in bonus contracts on financial and non-financial performance.

In contrast to the TQM model, standard economic theory suggests that, at the firm level, voluntary pollution reduction cannot be financially justified because pollution is an externality. Absent regulation, the costs of pollution are borne by the public and not by individual polluters (Milgrom and Roberts 1992). Of course, in the U. S. and many other countries environmental regulations are fairly strict and the penalties for violation can be harsh. Thus, regulation imposes additional production costs on many manufacturing and some service firms. There is general agreement that this cost is quite high (Jaffe et al., 1995).

There has been a rather lively debate among economists about the theoretical possibility of a positive relationship between environmental performance and economic performance (Jaffe et al., 1995; Palmer et al., 1995; Porter and van der Linde, 1995a, 1995b). Most of the differences between among the researchers hinge on the reference to either static or dynamic economic environments. Porter has been the most outspoken supporter of a dynamic view of environmental regulation that provides economic benefits to firms through increased learning and innovation over time (Porter, 1991; Porter and

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van der Linde, 1995a, 1995b). There is some anecdotal evidence to support this claim (Fisher and Schot, 1994; Lanen, 1999). Empirically, however, no systematic relationship between environmental compliance costs and successful patent applications has been found (Jaffe and Palmer, 1997) and the effects of environmental performance on productivity are inconclusive (Jaffe et al., 1995).

Russo and Fouts (1997) found a positive relationship between environmental performance and Return on Assets (ROA) with evidence of higher returns to environmental performance in high growth industries. Overall, however, empirical studies have found that the relationship between environmental performance and concurrent financial performance is negative, or at best zero, as many economists would predict (Freedman and Jaggi, 1992; Jaggi and Freedman, 1992).

Despite these findings, there is some empirical evidence supporting the argument that increases in environmental performance reduce future regulatory and liability risks relating to accidents (Klassen and McLaughlin, 1996) and are, therefore, priced by the market (Johnson et al., 1996). For example, Konar and Cohen (1997) found that environmental performance measured as levels of indexed pollution emissions and environmentally related lawsuits pending is negatively related to intangible asset value in a subset of S&P 500 firms.

Static externality models (eg. Palmer et al., 1995) predict that firms should reduce pollution emissions only in response to regulations, but, voluntary over-compliance with environmental regulations does exist. The EPA hails its voluntary 33/50 program as an enormous success and sponsors several other voluntary emissions and energy use reduction programs. This voluntary program was initiated in 1991 and encouraged firms

to reduce their emissions of seventeen toxic chemicals by thirty-three percent by 1992 and by fifty percent by 1995. In addition, the 1996 Toxics Release Inventory (TRI) public data release shows a voluntary reduction of nearly 50% in the releases of toxic chemicals over the previous decade.¹

Some voluntary emissions reductions may be simply a by-product of investment decisions, such as equipment upgrades or customer-required product changes that also happen to have a positive environmental effect. Reductions could also be a function of the fact that compliance investments can be lumpy in their effects resulting in unintentional over-compliance (Arora and Cason, 1995). First-mover firms may be able to reap the benefits of selling pollution technology and may intentionally over-comply in order to guide regulatory authorities to set tighter standards for the industry, thereby raising the cost of compliance for other firms and restricting competition (Cairncross, 1990; Klassen and McLaughlin, 1996). Compliance in anticipation of future regulations gives managers flexibility to make cost-effective emission reductions without the threat of non-compliance fines and penalties (Boyd, 1998a; Cairncross, 1990).

Other strategic benefits may result from voluntary reductions. Pressure from environmental groups, customers, and community members, at least in certain geographical regions and industry sectors, can be extremely high. The reputations of poor performers may make it harder for them to win permission for expansion, to recruit and

¹ The Emergency Planning and Right-to-Know Act (EPCRA) was enacted in response to the Union Carbide chemical release accident in Bhopal, India. Section 313 of EPCRA established the Toxics Release Inventory (TRI) program. TRI is a national database that identifies facilities and chemicals manufactured and used, released and otherwise managed at each facility. The TRI Program has collected and made this information public since 1987. As of 3/24/03, the 2000 Public Data Release can be accessed at <http://www.epa.gov/tri/>

motivate staff, and to attract customers (Cairncross, 1990).

A study by Cram (1997) supports this notion of public influence. He founds that a large, unidentified, U. S. chemical company implicitly prices public commitments to pollution reductions in capital budgeting decisions. These positive prices existed when controlling for the financially quantifiable Net Present Value (NPV) of the individual investments. In other words, the company placed a significant positive value on public promises to reduce emissions which, in turn, influenced their capital budgeting decisions.

Also, representatives of the EPA have publicly stated that, given the agency's scarce resources, scrutiny is focused on the worst polluters. Facilities with good track records are less likely to be audited by the agency. In addition, positive environmental performance on the whole may reduce fines and penalties when accidents occur and may be an advantage in court (Epstein, 1996). The sentences imposed on officers of corporations convicted of federal environmental offenses may be reduced if it can be shown that an environmental compliance program has been instituted. No reduction in sentences is allowed if there are no explicit incentives for environmental compliance within the firm (Hamner and Stinson, 1995).

The existence of voluntary pollution reduction goals and achievements within firms suggest that there is a positive financial performance effect of improved environmental performance beyond simple compliance with regulations. Admittedly, this financial effect may occur in the distant future. As with quality performance, voluntary environmental performance also appears to exhibit characteristics that should make it an appropriate non-financial performance measure for inclusion in the model.

The Effects of Institutional Factors on Financial and Non-Financial Performance

The model in this study includes three institutional factors that may affect financial and non-financial performance. These factors are the stage of the process toward quality and environmental performance goals, the amount of reliable cost information available and the control that a particular manager has over capital investment decisions that affect his or her own plant. These three factors were chosen for this study because they were highlighted in personal and telephone interviews with plant managers in the chemical, automobile and automobile parts industries and because of the importance of the factors in the studies discussed below.

The Stage of process toward quality and environmental performance goals

Executives often make reference to the phenomenon of the “low-hanging fruit” when discussing the inevitable tradeoffs that result from improved environmental performance. It seems to be an accepted, but untested, phenomenon that the “farther companies travel along the road to zero emissions, the smaller the returns will become” (Cairncross, 1990, p. 9). Comments such as the following are typical:

“We picked the low-hanging fruit first, in the 70's and 80's,” emphasized Edward E. Quick, the environmental manager for Celanese. “As we move into the 1990's we're finding the available technology much more costly.” (Meyerson, 1998, 1)

“Enlightened companies have exhausted many of the relatively easy energy, waste, and resource-efficiency options. They are now into the harder, longer term investment commitments in which conventional economic and environmental criteria are not necessarily in harmony.” (Fischer and Schot, 1994, 46-47)

As described, this phenomenon implies that investments made in the early stages of an environmental management program are generally not costly and often yield high financial and environmental payoffs. In later stages, investments become expensive and



complex and the payoffs become highly uncertain at best. Thus, it appears that a non-linear relationship may exist between investment and payoff that could affect the outcome of performance evaluation choice. Lanen (1999) studied waste reduction at 3M Corporation. He found that performance improvements were negatively associated with baseline performance and plan age, but was not able to measure returns to investment for his sample.

The “low-hanging fruit” phenomenon has also been documented in the quality literature (Ittner and Larcker, 1996; Atkinson et al., 1994). Ittner and Larcker (1996) found decreasing returns to quality improvement programs over time, with returns measured as self-reported costs-of-quality. The results are similar when customer satisfaction is used as a proxy for product quality. Ittner and Larcker (1998) found that customer satisfaction was a leading indicator of future accounting earnings, growth in customers and customer purchase behavior. This relationship appears to be non-linear with diminishing returns to customer satisfaction at high levels of satisfaction.

In contrast, multi-period dynamic quality-based learning models suggest that firms may actually achieve increasing quality returns to investment over time (Fine 1986; Marcellus and Dada 1991). Empirically, Ittner (1994) examined the reported quality costs of 49 plants over a mean period of nearly five years. He found that 29 of the 39 plants that reported reduced nonconformance costs (a return measure) also reported reduced expenditures on conformance activities (an investment measure). Individual time series analysis of the quarterly cost data of 24 of the plants showed that reductions in failure costs were associated with simultaneous reductions in prevention and appraisal costs. Ittner et al. (1998b) examined 13 plants of a single company and found that the

prevention and appraisal costs of the plant appeared to be contingent on the levels of quality experienced during the period. Their findings are consistent with the quality learning models that suggest that quality expenditures can be reduced as quality improves.

The empirical evidence of increasing returns to quality expenditures provided by Ittner (1994) and Ittner et al. (1998b) is not inconsistent with the “low-hanging fruit” story. Neither study examines the behavior of quality costs at very high levels of quality. As Ittner et al. (1998b) point out, quality cost tradeoffs and performance implications may be different at higher quality levels than those achieved by their research site. Given empirical and anecdotal evidence regarding the “low-hanging fruit”, or stage effect, it is expected that non-financial performance will decrease as a firm approaches the later stages of quality or environmental programs and experiences decreasing returns to investment.

Information and Decision Rights

Jensen and Meckling (1992) argued that decision rights should be co-located with agents that have specific information. Simultaneously, reward systems that are designed to align the interests of the principal and the agent should be implemented in order to make sure that the agents do not misuse the information and decision rights.

Accordingly, Wruck and Jensen (1994) argued that incentives must complement the co-location of decision rights and information in order to implement a successful TQM program. By the same argument, it would not be optimal to provide incentives to agents without ensuring that the agents have appropriate information and decision rights.

Even though a compensation system may align the interests of the agent with those of the principal, the agent may not be able to take appropriate actions due to poor information or a lack of decision rights. It is possible that the rights assignment and information problem may have adverse effects on quality and environmental decision making and outcome performance (Epstein 1996; Joshi, et al. 2001). This study will focus on the effects of two contingency factors that have been highlighted in recent academic, practitioner and EPA literature as obstacles to increased financial, quality and environmental performance: traditional cost accounting and capital budgeting decision-making systems.

The Amount of Reliable Cost Information Available

Traditional cost accounting systems may not provide sufficient or appropriate information to support effective TQM or EMS decision-making. Previous studies have suggested that new manufacturing practices require new sources or types of information (Ittner and Larcker 1995; Wruck and Jensen 1994). This is particularly true in the case of environmental management. Recall that the effects of pollution are not fully realized by polluting firms. Without market prices or explicit bargaining with affected parties, managers may not have the information on the costs and benefits of their actions that is necessary help them to accomplish environmental goals (Milgrom and Roberts, 1992). At the very least, managers will require accounting information regarding the costs of pollution emissions within their own facilities in order to make informed decisions regarding pollution reduction.

Traditional accounting systems tend to hide environmental costs in overhead accounts and fail to consider all of the potential environmental costs associated with the

firm's activities (Epstein 1996; McLaughlin and Elwood 1996; Walley and Whitehead 1994). A survey of management accountants found that 70-80% of the respondents allocated environmental costs to overhead. These overhead costs were usually reallocated to products or processes based on labor hours, production volume and other volume related cost drivers (White et al. 1995). This leads to the standard problem of under/over-costed products that may result in inefficient resource allocation.

In addition, firms tend to assign a value of zero to these “hidden costs” in capital budgeting, product pricing, product and process design, and purchasing decisions (Epstein, 1996). This practice results in a systematic bias against decisions that will produce environmental benefits (Porter and van der Linde 1995a, 1995b).

Joshi, et al. (2001) analyzed plant level data from 55 steel mills and found that “hidden” environmental costs are 9 – 10 times higher than those identified by the plants costing systems. The authors conclude that the underestimation of costs may lead to the aforementioned distortions in decision making.

The under-reporting of the costs and benefits of quality performance is also a problem within firms (Ittner et al. 1998b; Ittner and Larcker 1996; Nandakumar 1993). Cost-of-poor-quality systems tend to track only direct and easily measured costs. In a survey of manufacturing plants, Ittner and Larcker (1996) found that internal costs such as scrap, rework, inspection and testing, planning and analysis, warranties and returns and training were most often tracked by accounting systems. External costs were often not measured, reflecting the difficulty of estimating customer-related costs and benefits associated with quality improvement. Ittner et al. (1998b) determined that the reported

quality costs of thirteen plants significantly understate the financial benefits of quality improvements.

While the use of non-financial performance measures in bonus contracts may increase the willingness on part of an agent to invest in quality enhancing or pollution reducing investments, the agent may not know the most cost efficient means to do so because he does not have the appropriate information. Therefore, it is expected that the availability of such information will be associated with higher financial performance.

Control Over Capital Investment Decisions

As previously discussed, the benefits of pollution reduction and quality investments are largely underestimated by accounting systems and the costs of pollution and poor quality typically are not adequately tracked within organizations. Capital budgeting decision-making processes that do not correct for these underestimates tend to be biased against the acceptance of quality and environmental investments. It is often the case that quality and environmental projects compete for scarce funds with all other types of investment opportunities. This practice combined with the use of all unadjusted traditional methods of screening and approval of capital investments, such as Net Present Value (NPV), Internal Rate of Return (IRR), Return on Investment (ROI) and Payback may bias against approval of quality and environmental projects given scarce investment resources.²

² Four chemicals and automotive parts managers were interviewed in person or over the telephone during the preliminary stages of this study. Each manager stated that the capital budgeting practices of their respective companies were too rigid to adjust for the difficulties inherent in estimating the benefits of environmental investments. Discussions with two EPA consultants confirmed that this is a common problem with the companies that they work with.

Flexibility in capital budgeting decision making systems should provide managers additional decision rights necessary to make investment choices that adjust for this bias. Atkinson et al. (1994) proposed a system for evaluating investment opportunities which incorporates both financial and non-financial quality information. The assignment of non-zero weight to non-financial benefits in the investment approval process is also proposed by Boyd (1998b) as an improvement upon the standard financial analysis of environmental investments.

Decision rights over investment choices should give managers the flexibility to take actions that are suggested by their incentive systems, thereby increasing quality and environmental performance. Such management decision influence may take the form of weighted non-financial characteristics, separate evaluation of quality and environmental investments, or other adjustments to the capital budgeting decision making process.

Contributions to the Literature

This study examines the association between the weight placed on quality and environmental performance measures in the bonus contracts of plant managers and financial and non-financial performance. It also attempts to measure the direct and indirect effects of three institutional and process related variables on financial and non-financial performance. This study will contribute to several literature streams in various ways.

The study extends previous work on the associations between non-financial performance measures, non-financial performance and financial performance. Ittner and Larcker (2001) outline several limitations in the work on this issue to date. They state that non-linearity in various relations has not been adequately incorporated into

performance measurement models. This study addresses this issue by attempting to measure the process stage of environmental and quality performance for each plant and including that measure explicitly in the model.

They state that results in this area seem to vary by industry and suggest that tests should be conducted over a broad range of industries. They also point out that, due to data limitations, little is known about the incentive systems of lower-level (below CEO) employees even though their impact on performance can be substantial. This study addresses both of these issues by creating a sample from four manufacturing industries and by focusing on the bonus plans of plant managers.

Ittner and Larcker (2001) also state that past studies of the value relevance of non-financial performance measures tend to look at only one value driver and ignore potential interactions with other value drivers. They suggest that it is possible that non-financial performance measures could be highly correlated as substitutes or complements. This study includes two non-financial performance measures which are, in theory, positively correlated.

They also point out that previous empirical work in this area has ignored contingent factors that may moderate the relation between the value driver and performance. They add that previous studies have tended to overlook the quality of information used for decision making and control even though this aspect of information may affect the quality of decisions made and the effects of incentive and control systems. This study addresses both of these issues. The amount of reliable environmental and quality cost information available and the capital budgeting decision making control that a manager has are both included as variables in the study's model.

This study will also contribute to the quality and environmental program design literature by investigating whether the inclusion of quality and environmental performance measures explicitly into the bonus contracts of managers has a positive or negative effect on quality and environmental performance. This has been an area of much disagreement.

Finally, this study should contribute to the quality and environmental literature on the association between non-financial and financial performance. Recall that the results of the diverse studies in this area are mixed. Few of the previous studies have examined these relations at the plant level, particularly in the environmental literature. This study should serve to enrich this small, but growing, stream of literature.

CHAPTER 3

HYPOTHESES

The Effects of Non-Financial Measures in Incentive Contracts

This study proposes an empirical model that is based on the multi-action agency model of Feltham and Xie (1994). In particular, it provides evidence on the theory that, under certain conditions, non-financial measures can add value to an incentive contract in which a myopic measure is used. This study assumes that short-term measures of financial performance are myopic and tests whether the non-financial performance measures in a bonus contract will make the agent's actions more congruent with the goals of the principal.

One key assumption of this and other studies that attempt to measure the performance effects of performance measurement and other accounting choices is that individual firms are exhibiting sub-optimal behavior at any particular point in time. The cross-sectional variation across firms inform us about the relation between accounting or measurement choice and performance (Ittner and Larcker, 2001). This study not only relies on this assumption, it also assumes that goals of the sample firms include increased quality and environmental performance. This assumption does not appear to be unreasonable given the previously discussed theoretical benefits of improved performance on these two measures such as reduced costs, increased revenue due to improved customer satisfaction, reduced penalties due to environmental accidents, benefits of improved reputation and product and process improvements.

The first model of this study tests whether the inclusion of quality and environmental bonus plans of plant managers will improve the plant's performance on

those measures. Specifically, it is expected more heavily weighted non-financial measures in bonus contracts will be associated with higher non-financial performance.

H1a: There is a positive association between the weight placed on quality performance in the annual bonus contract and performance.

H1b: There is a positive association between the weight placed on environmental performance in the annual bonus contract and environmental performance.

The model constructed to test H1 assumes that quality and environmental performance are leading indicators of future financial performance. Unfortunately, this expected association between current non-financial performance and future financial performance cannot be tested due to the data limitations of the sample. Nonetheless, it is possible for current financial performance measures to reflect the benefits of current quality and environmental performance. Indeed, Feltham and Xie (1994) model implies that this result is possible under certain circumstances; namely risk reduction to the agent or increased incentive intensity.

Firms may use additional non-financial performance measures in compensation contracts in order to increase the motivation for, or reduce the risk of, actions to improve non-financial performance. If this is the case, it is expected that financial performance will be positively associated with quality and environmental performance when explicit quality and environmental performance measures are included in bonus contracts.

H2a: There is a positive association between financial performance and quality performance when weight is placed on quality performance measures in annual bonus contracts.

H2b: There is a positive association between financial performance and environmental performance when weight is placed on these environmental performance measures in annual bonus contracts.

The Effects of Institutional Factors on Financial and Non-Financial Performance

The Stage of Process Toward Quality and Environmental Performance Goals

There is anecdotal evidence of decreasing financial returns to environmental investments. In addition, some empirical evidence suggests diminishing returns to customer satisfaction performance and mixed evidence of a non-linear relationship between quality performance and financial performance. This study does not attempt to specify a non-linear relation between financial performance and quality and environmental performance. However, the study does address whether experiencing decreasing returns to quality and environmental investments makes improvement of quality and environmental performance more difficult. Specifically, it is expected that there will be a positive association between non-financial performance and the interaction between the weight on quality and environmental performance in the bonus contract and perceived increasing marginal returns to quality and environmental investments.

H3a: The weight placed on quality performance measures in annual bonus contracts will have a more positive effect on quality performance when increasing marginal returns to investment are experienced.

H3b: The weight placed on environmental performance measures in annual bonus contracts will have a more positive effect on environmental performance when increasing marginal returns to investment are experienced.

Incentives, Information and Decision Rights

Jensen and Meckling (1992) suggested that there were three institutional factors that are complimentary within a firm. Specifically these factors are the location of decision rights and specific knowledge or information and the incentive system. Demers et al. (2002) found that these factors are generally jointly determined in a subset of internet companies. The current study does not measure the interdependencies of these

three factors. However, complimentary effects of these factors are predicted to be associated with improved financial and non-financial performance. Specifically, it is expected that there is a positive association between financial performance and the interaction between availability of reliable quality and environmental cost information and the weight on quality and environmental performance in the annual bonus contract.

H4a: The weight on quality performance measures in annual bonus contracts will have a more positive effect on quality performance when reliable quality cost information is available.

H4b: The weight on environmental performance measures in annual bonus contracts will have a more positive effect on environmental performance when reliable environmental cost information is available.

It is also expected that there is a positive association between quality and environmental performance and the interaction between specific decision rights, namely capital investment decision rights, and the weight on quality and environmental performance in the annual bonus contract.

H5a: The weight placed on quality performance measures in annual bonus contracts will have a more positive effect on quality performance when capital investment decision rights can be exercised.

H5b: The weight placed on environmental performance measures in annual bonus contracts will have a more positive effect on environmental performance when capital investment decision rights can be exercised.

CHAPTER 4

RESEARCH METHODS AND RESULTS

Sample Selection and Research Methods

In the early stages of this study, executives of several companies in various industries were personally contacted and asked to participate in a field study. Each of the executives expressed an interest in the topic of this study and the results. They refused to participate, however, due to the sensitive nature of the data and institutional decision making information requested. They were particularly concerned about the potential of attracting the attention of the EPA towards their companies. One senior manager stated that he was specifically concerned that the EPA would subpoena the collected data and use that as a steppingstone to examining the internal documents of the company. Contacts at the EPA confirmed that the concerns of the executives were indeed appropriate.

Consequently, data for this study was collected from mail surveys of plant/operations managers in four industries. The industries were chosen based on Toxics Release Inventory (TRI) performance because this public data is a key objective measure of environmental performance in this and previous research.³ There is no

³ A facility must report releases of listed chemicals if it belongs to certain SIC codes industry sectors, has 10 or more full-time equivalent employees and manufactures or processes more than 25,000 pounds or uses more than 10,000 pounds of any listed chemical per year. The EPA's listed chemicals are considered to be the most toxic chemicals in use, not all chemicals. Listed chemicals change periodically, but not during the time period covered by this study. Additional information regarding TRI data can be found at <http://www.epa.gov/tri/tridata/tri00/press/overview> as of March, 2003.

known source of public information on quality performance at the firm or plant level. The chemical (SIC 28) and paper (SIC 26) industries were chosen because they are relatively high polluting industries. Over the time period of 1988 – 1998 the chemical industry reduced its TRI releases by 57%, while the paper industry reduced its releases by only 14%. The furniture (SIC 25) and plastics (SIC 30) industries were chosen because they are medium-level polluters. Over the same time period the furniture industry reduced its releases by 73% and the plastics industry reduced its releases by 39% (U.S. EPA, 1998). This cross section of industries provides variation in environmental performance.

A list of names and addresses of plant/operations managers in the four industries was collected using the TRI database. This list was manually filtered to target plants with the highest levels of pollution and to eliminate plants that were no longer in production.⁴ Each plant was then contacted by telephone in order to confirm the name of the plant/operations manager and the mailing addresses. This exercise also served as a second way of identifying plants that had closed. The final sample consisted of 1,257 plants of which 278 were in the furniture industry, 319 were in the paper industry, 549 were in the chemical industry and 111 were in the plastics industry. Of the total sample, 682 were plants in where a specific name of a plant/operations manager was obtained.

⁴ The TRI database provides data on the pounds of chemicals released. This data is not scaled by production levels or full-time equivalent employees. Therefore, in its raw form it does not provide information regarding facility performance in general or relative to other facilities in its industry. A high level of releases does not necessarily imply poor environmental performance. The decision to target plants with the highest levels of pounds of emissions was made in order to survey plants where environmental performance might matter enough to include incentives in a bonus plan. It was not intended to limit the variability of the environmental performance variable and should not cause bias because the dependent variable, pounds of emissions scaled by full-time equivalent employees, was not known until the completed survey was received.

In order to maximize response rates to the survey instrument, a modified version of the Dillman (1991) method was used. Two mailings of the survey were sent to the full sample of plants. The second mailing occurred approximately two weeks after the first mailing. The cover letter of introduction emphasized that all responses would be kept confidential and would be analyzed in the aggregate (See Appendix A). A letter written by APICS-The Education Society for Resource Management was included with each survey (See Appendix B). This society is widely recognized and highly regarded in the manufacturing community. The letter expressed support for the project and encouraged participation.

A total of 119 survey responses were received of which 117 were usable. Twenty surveys were returned as undeliverable. Accordingly, the response rate to the survey was approximately 9% of the full sample. While this response rate is low, it is consistent with the rates of other recent independent mail surveys regarding business practices. Of the total usable responses 22 were from managers of furniture plants, 31 were from managers of paper mills, 55 were from managers of chemical plants and 9 were from managers of plastics plants. Sixty-nine responses were from managers that had been contacted directly by name and seventy-five were responses from the first mailing.⁵

⁵ Tests for non-response bias were performed on respondent/non-respondent emission levels for the years 1996 and 1997 by industry. Two sample unpaired t-tests were performed under the assumption of unequal variances. In the furniture industry the respondents mean emissions were smaller than non-respondents in 1997 and there were no differences at the .05 significance level in 1996. In the paper, chemicals and plastic industries for both years the mean emissions of the respondents were larger than the non-respondents ($p < .05$). It cannot be determined if the larger emissions are a result any particular plant being heavier polluter or simply a larger facility. There is no measure of size available for the non-respondents.

Dependent Variable Construction

In the survey design phase of this study a pilot survey was sent to 329 plant managers in the automotive parts industry. The pilot survey asked the managers to provide either levels or change from prior period information on specific quality and financial performance measures for their plants. Of the 41 responses received, most refused to provide this information citing data sensitivity issues. Therefore, the survey constructed for this study asked the respondents to provide the year-to-year levels of quality and financial performance for their plant but they were not asked to disclose the *type* of measure that they were using (see Appendix C for the survey instrument). So, the survey data provides levels of performance on the dependent variables, but what those measures represent (except in a few cases) was not collected. This method of response provides a way of addressing confidentiality issues and thereby increasing response rates, but results in noisy measures of the dependent variables relating to quality and financial performance. As discussed below, outlier performance measure responses were trimmed resulting in a loss of data. Most importantly, interpretation of the results is difficult because it must be assumed for the statistical tests that the responses reflect comparable measures. Though this measure of data collection introduces considerable noise into the data, it is not an obvious source of bias.

The respondents were asked to provide the levels of their most important external quality measure on an annual basis. Examples of external quality performance measures are number of on-time deliveries, customer satisfaction and defective parts per million. They were also asked to indicate whether their performance on this variable had improved from year to year. Nearly all respondents indicated that an increase in this

measure was an improvement. Thirty-three responses (9%) were eliminated from this analysis because they indicated that an increase in this measure indicated a decrease in performance. This indicated that these respondents' external quality performance measures were different from the external quality performance measures of the majority of the respondents and, therefore, were not comparable. The range of the omitted responses was .92 – 4,500 with nineteen in the range of .92 – 54. The average of the retained responses was 89.5 with a range of 70 – 99. Again, these responses represent the annual level of the most important external quality measure. The measure itself may not be the same across responses.

The respondents were also asked to provide the levels of their most important internal quality measure on an annual basis. Examples of internal quality performance measures are scrap or rework rates. They were also asked to indicate whether their performance on this variable had improved from year to year. Nearly all respondents indicated that a *decrease* in this measure was an improvement. Of the total responses, 113 (32%) were eliminated from this analysis because they indicated that an increase in this measure indicated an increase in performance. Again, this implied that these respondents' measure of internal quality performance was different from the majority of the respondents and, therefore, not comparable. The range of the omitted responses was 20 - 350 with 102 omitted responses in the range of 60 – 99. The average of the retained responses was 4.8 with a range of .005 - 20. This represents the annual level of the most important internal quality measure. The measure itself may not be the same across responses.

Quality performance was dichotomized into external quality measures and internal quality measures because production facilities tend to measure them separately. Ponemon et al. (1994) found that companies in the early stages of quality improvement tend to focus on external failure rates at the expense of internal failure rates.

Data on environmental performance has been collected from the EPA's TRI database. This database provides levels of chemical emissions measured in pounds on a facility level. While types of chemical emissions are categorized in the TRI reports, they have been aggregated for the purposes of this study because it is assumed that the plants are attempting to reduce overall emissions and not specific categories such as air emissions. The reported emissions have been scaled by the self-reported full-time equivalent employees for each facility as a proxy for production levels.

Independent Variable Construction

To measure the weight placed on quality and environmental performance two different measures were combined. First, the survey asked the respondents to estimate their ex ante expectations of the percentage of their bonus that was based on the quality management (internal quality) and customer satisfaction (external quality) performance of their plants for each of the years 1997 – 1999. The respondents were also asked to estimate the percentage of their bonus that was based on environmental performance for the same time period as well as other financial and non-financial performance measures. The bonus percentages were forced to sum to one-hundred percent. Respondents allocated percentages to other financial and other non-financial categories in order to reach that 100%. All bonus responses correctly summed to a total of one-hundred percent.

Second, in three separate questions the respondents were asked to rate the significance of their bonus to them on a six – point Likert scale. This is intended to represent a crude measure of incentive intensity because the actual dollar amount of the respondents' bonuses is not known. The confirmatory factor analysis factor loadings on the three bonus significance questions ranged from .64 to .77 (Table 1, A) and the Cronbach alpha of the three bonus significance items was .74 (Table 2). The three items that measure intensity were averaged and multiplied by the bonus percentages for internal quality, external quality and environmental performance in order to create the independent variables INTQWTSIG (internal quality), EXTQWTSIG (external quality) AND ENVWTSIG (environmental quality). These variables proxy for the weight placed on internal quality, external quality and environmental performance in the respondents' bonus contracts. Descriptive statistics for these variables are reported in Table 5. Recall that H1a and H1b propose a positive association between the weight placed on these non-financial performance measures and the respective non-financial performance.

The remaining independent variables are reported decreasing returns to quality (H3a) and environmental (H3b) investments, availability of reliable quality cost (H4a) and environmental cost (H4b) information, and quality (H5a) and environmental (H5b) capital investment decision rights. These variables were measured by answers on a six-point Likert scale anchored by completely disagree and completely agree. Table 1 reports the factor loadings from Principal Components Analyses performed on responses relating to these variables. A Principal Components Analysis was performed separately for each of these variables. Table 2 reports the Cronbach alphas, means, standard deviations, theoretical and actual ranges of the variables.

The stage items attempted to measure the stage at which the plant was operating in regard to the quality and environmental improvement process. These stage measures relate to H3a and H3b. The process stage for each of the quality and environmental processes was measured by four questions. Table 1, Panel A shows the results of confirmatory factor analyses in which these four questions loaded on two separate constructs for both quality and environmental performance stage. The first two questions relating to quality stage loaded on a construct labeled QPOS1. These questions related to the existence of inexpensive and cost effective opportunities for product quality improvement. The second two questions loaded on a construct labeled QPOS2. These questions related to the existence of decreasing returns to quality investments. Table 2 reports Cronbach alphas for these measures of .82 and .48, respectively. The first two questions relating to environmental stage loaded on a construct labeled EPOS 1. These questions related to the existence of inexpensive and cost effective opportunities for pollution reduction. The second two questions loaded on a construct labeled EPOS2. These question related to the existence of decreasing returns to pollution reduction investments. The Cronbach alphas for these measures are .90 and .57, respectively.

The information systems questions provided a measure of the availability of extensive and reliable quality and environmental cost information within the plant which is used for examining H4a and H4b. Four items measured quality information systems and their underlying construct is labeled QUALIS. Table 1, Panel B shows that the factor loadings on these four questions range from .54 to .68. Table 2 reports a Cronbach alpha for this measure of .89. Five items measured environmental information systems and their underlying construct is labeled ENVIS. The factor loadings on the third and fifth

questions are quite low (.37 and .49, respectively). Nevertheless, the questions have been retained in this measure because omitting them does not change the outcome of the OLS regressions reported in this section. Also, the Cronbach alpha for the ENVIS measure including all five questions is .79 and is acceptable.

The capital budgeting practice questions provided a measure of the degree of influence or control that the manager had over the plant-level quality and environmental investment choices used to examine H5a and H5b. Four questions (see Appendix C, Section D, the first four questions) measured control over quality investment decisions and the underlying construct is labeled QUALCB. The factor loading on the fourth question is .45. The question has been retained in the QUALCB measure for three reasons. First, it is the question that most directly addresses the issue of control over quality capital budgeting decisions. Second, omitting this question from the measure or including it as a separate measure in the subsequent OLS regressions does not significantly alter the results. Finally, the Cronbach alpha on the QUALCB measure including all four questions is .71 and is acceptable.

Five questions (see Appendix D, Section D, questions 8 – 12) measured control over environmental investment decisions. The factor loadings on the first two questions are low at .38 and .34, respectively. Including these two questions as a separate measure in the OLS regression test of H5b does not alter the overall results, so the questions have been omitted from the analysis. The last three questions have been retained and the underlying construct is labeled ENVCB. The Cronbach alpha of this measure is .64.

Descriptive Statistics

A maximum of three years of levels data was collected from each respondent when possible. This is because respondents were asked to provide estimates of their ex ante expectations of the weight placed on various financial and non-financial measures in their annual performance review and in their annual bonus for the years 1997-1999 to collect key independent variable data. They were also asked to provide quality and financial performance levels information for the years 1996-1999 for dependent variable data. The amount of information provided by the respondents on these variables varied based on years in the position and memory constraints. Therefore, sample size varies between the models included in this study. As discussed above, the respondents also provided current measures of the independent variables relating to bonus significance, process stage, cost information availability and capital budgeting processes. It is assumed that the responses to these questions would not change for the years 1996-1999. To the extent that this is not true, additional noise is introduced into the measurement of these variables.

Table 3 provides descriptive statistics relating to the structure of the managers' annual performance reviews. The data in this table is provided in order to compare the structure of annual reviews with the structure of bonuses in Table 4. Annual review weights differed among industries. Managers in the paper and plastic industries reported the highest weight placed on quality management in their annual performance review (11% and 10%, respectively). Managers in the furniture and chemicals reported the highest weight placed on customer satisfaction in annual reviews (13% and 11%, respectively). Managers in the paper and chemicals industries reported the highest

weight placed on environmental performance (6% and 11%, respectively). Overall, the managers in the chemical industry reported a total of 56% of weight in the annual performance reviews was placed on non-financial performance measures.

Table 4 provides the respondents ex ante expectations of the weight placed on various financial and non-financial measures in their annual bonus. Consistent with the annual review weights, the managers in the chemical and plastic industries reported the most weight placed on quality management (6% and 17%, respectively) for their annual bonus. Consistent with annual performance reviews, managers in the furniture and chemicals industries reported the most weight placed on customer satisfaction (6% for each). Managers in all four industries reported that very little weight was placed on environmental performance with the largest weight of only 7% reported by managers in the chemicals industry. Overall, the same managers reported that 35% of the weight in their bonuses was placed on non-financial measures.

In order to test whether the weight on each of the performance measures in Table 3 was significantly different from the weight on the measures in Table 4 two sample, paired t-tests were performed under the assumption of unequal variances. The mean weights in the annual performance review were significantly different from the weights in the annual bonus for all categories except for plant financial performance and other non-financial performance measures ($p < .05$).

Table 5 reports the means and standard deviations of the dependent and independent variables used to examine H1 – H5. Interpretation of the means of the dependent variables is difficult due to the previously discussed inherent measurement difficulties. The mean of the independent variable ENVWTSIG, representing the weight

placed on environmental performance in the bonus contract multiplied by bonus significance, is small and consistent with the low weights reported in Table 4. The means of the variables EXTQWTSIG and INTWTSIG, representing the weight placed on external and internal quality performance, respectively, multiplied by bonus significance, are larger but still quite small.

The descriptive statistics for the balance of the independent variables reported in Table 5 represent the mean values of constructs that are measured by items that can take on values ranging from 1 - 6. On average, the managers reported fewer cost effective and inexpensive opportunities exist for environmental improvement (EPOS1) than for quality improvement (QPOS1). Consistent with this result, the managers reported that they were closer to facing diminishing returns to investment for environmental investments (EPOS2) than for quality investments (QPOS2). The managers also reported that their financial quality information (QUALIS) was slightly more reliable and useful than their financial environmental information (ENVIS). Finally, the managers reported that they had slightly more control over their quality investment choices (QUALCB) than their environmental investment choices (ENVCB).

Results: Hypotheses 1a, 3a, 3b, 5a and 5b

The first set of tests examine models of the non-financial performance effects of the weight placed on quality and environmental performance in bonus contracts, stage effects and the interaction of capital investment decision rights and quality and environmental bonus weights. H1a predicts that there will be a positive association between the weight placed on quality performance measures in a bonus plan and quality performance. H3a predicts that there is a positive association between quality

performance and the interaction between the weight on quality performance measures in the bonus contract and reported increasing marginal returns to quality investments. H5a predicts that the interaction between capital investment decision rights relating to quality investments and the weight on quality performance measures in the bonus contract will be positively associated with quality performance. Model 1(a) represents these hypotheses.

Model 1(a):

$$QPERF_t = \alpha_0 + \alpha_1 QPERF_{t-1} + \alpha_2 QWTSIG_t + \alpha_3 QPOS_t + \alpha_4 QWTSIG_t * QPOS_t + \alpha_5 QUALCB_t + \alpha_6 QUALCB_t * QWTSIG_t + \alpha_7 AGE_t$$

Where:

QPERF = Quality performance levels.

QWTSIG = The weight attached to quality performance*bonus significance.

QPOS = Two measures of decreasing returns to quality investments.

QUALCB = Measure of quality capital investment decision rights.

AGE = Age of facility.

Quality performance for the previous year ($QPERF_{t-1}$) is included in this levels model in order to control for time-series trends (Banker et al 2000; Ittner and Larcker 1998; Sim and Killough 1998).^{6, 7}

⁶ Prior studies have also tested models with performance as a dependent variable as change models (Banker et al 2000; Ittner and Larcker 1998; Sim and Killough 1998). That is, both the dependent variable and independent variables are measured as changes. This model provides econometric benefit of reducing bias relating to omitted variables and spurious correlations (Banker et al. 2000, Wooldridge 2000). Some independent variable changes have not been measured for this study in order to reduce the length of the survey and thereby increase the response rate. Therefore, OLS regressions with performance changes as the dependent variable measured as changes and the independent variables measured as levels were performed. The results were not significantly different from those of the levels models and are not reported here.

⁷ The Cook-Weisberg test for heteroscedasticity and visual inspection of residual plots revealed heteroscedasticity for all of the levels models in this study. The results of these regressions are reported using Huber/White/Sandwich adjusted standard errors. Examination of Variance Influence Factors (VIF) for all models revealed the expected multicollinearity of the interaction terms with their interacted variables. In order to reduce the effects of variance inflation, interaction terms are dropped in regressions where their coefficients are not significant.

A control variable which measures the age of the plant is included in all models with non-financial performance as the dependent variable. Specifically, age is expected to be negatively associated with non-financial performance levels because of the difficulty of improving performance in older facilities.⁸

Tables 6 and 7 provide the results of the tests of Model 1(a). The internal quality performance results are presented in Table 6. Recall that the respondents indicated that a decrease in the reported internal quality performance measure was an improvement. In order to clarify the interpretation of regression results, the internal quality performance data has been coded to be negative. So an improvement in internal quality performance is an increase in that measure and the predicted signs on the INTQWTSIG and EXTQWTSIG variables are positive. Recall that H1a predicts that there will be a positive association between the weight placed on quality performance measures in a bonus plan and quality performance. Table 6, a model with internal quality performance and the dependent variable, shows that the coefficients on these terms are not significant at conventional probability levels.

The external quality performance results are presented in Table 7. The regression results show a positive association between external quality performance levels and the

⁸ Industry control variables were included in all of the models presented but were not significant. Therefore, they have been excluded from the analyses currently presented.

weight placed on internal quality performance measures ($p < .05$) and external quality performance measures ($p < .10$) after controlling for the effect of the interaction between the bonus weights and experienced decreasing returns to quality investments.

Tests of H3a are presented in Tables 6 and 7. H3a predicts that there is a positive association between quality performance and the interaction between the weight on quality performance measures in the bonus plan and reported increasing marginal returns to quality investments. The QPOS2 variable has been reverse coded in order to present a clearer interpretation of the results on the variable and its associated interaction term. Accordingly, a high response (say 6) on this variable represents reported low perception of decreasing returns to investment. Thus, a high response on this variable combined with high bonus weight is expected to be positively associated with performance levels. The interaction term is not significant in the internal quality performance model presented in Table 6 which does not support H3a.

The results of the external quality performance model presented in Table 7 do not support H3a either. The coefficients on the interactions between QPOS1 and the weight placed on internal and external quality performance in the bonus contract are not significant. The coefficients on the interaction terms of QPOS2 and the weight in internal and external quality measures in the bonus contract are negative and significant ($p < .01$ for both). This suggests that managers in the early stages of the external quality improvement process that have relatively high weight placed on internal and external quality in their bonus contracts are experiencing low external quality performance levels. It also suggests that managers that perceive high decreasing returns to quality investment

and have relatively lower weight placed on quality performance in their bonus contracts are experiencing high external quality performance levels.

H5a predicts that the interaction between capital investment decision rights relating to quality investments and the weight on quality performance measures in the bonus contract will be positively associated with quality performance. The results provide no support for H5a. The interaction of quality capital investment decision rights (QUALCB) and the weight on internal quality (INTQWTSIG) or external quality (EXTQWTSIG) in the bonus contract is not significantly associated with internal (Table 6) or external (Table 7) quality performance levels.

Model 1(b) provides a test of H1b, H3b and H5b. Specifically, H1 predicts that there will be a positive association between the weight placed on environmental performance measures in the bonus contract and environmental performance levels measured as pounds of TRI emissions weighed by the reported number of full-time equivalent employees. Note that a lower level of ENVPERF means lower levels of emissions, an indicator of good performance. This levels data has been coded negative to aid in the interpretation of the results. Therefore, all associations with this ENVLEVEL are predicted to be positive. H3b predicts that there is a positive association between environmental performance levels and the interaction of high environmental bonus weight and reported low experience of decreasing returns to environmental investment. H5b predicts that the interaction between capital investment decision rights relating to environmental investments and the weight placed on environmental performance in the bonus plan will be positively associated with environmental performance.

Model 1(b):

$$\text{ENVPERF}_t = \alpha_0 + \alpha_1 \text{ENVPERF}_{t-1} + \alpha_2 \text{ENVWTSIG}_t + \alpha_3 \text{EPOS}_t + \alpha_4 \text{ENVWTSIG}_t * \text{EPOS}_t + \alpha_5 \text{ENVCB}_t + \alpha_6 \text{ENVCB}_t * \text{ENVWTSIG}_t + \alpha_7 \text{AGE}_t$$

Where:

ENVPERF = TRI emissions levels scaled by number of full-time equivalent employees.

ENVWTSIG = The weight attached to environmental performance*bonus significance.

EPOS = Measures of decreasing returns to environmental investments.

ENVCB = Measure of environmental capital investment decision rights.

AGE = age of facility.

Table 8 presents the results of tests of Model 1(b). H1b, H3b and H5b are not supported in this model. Specifically, the coefficient on ENVWTSIG is not significant (H1b). The coefficients on the interactions between EPOS1 and bonus weight on environmental performance as well as EPOS2 and bonus weight on environmental performance are not significant (H3b). Finally, the coefficient on the interaction between ENVCB and bonus weight on environmental performance is also not significant (H5).

Results: Hypotheses 2a and 2b

H2a predicts that financial performance will be positively associated with quality performance when quality performance measures are included in the bonus plan of the manager. H2b predicts that financial performance will be positively associated with environmental performance when environmental performance measures are included in the bonus plan of the manager. Model 2b is constructed to assess the effects of the interaction between quality and environmental performance and weight placed on those performance measures in a bonus contract on financial performance.

Model 2:

$$FPERF_t = \phi_0 + \phi_1 FPERF_{t-1} + \phi_2 ENVPERF_t + \phi_3 QPERF_t + \phi_4 ENVWTD_t + \phi_5 QWTD_t + \phi_6 ENVPERF * ENVWTD_t + \phi_7 QPERF * QWTD_t$$

Where:

FPERF = Financial performance levels.

ENVPERF = Environmental performance levels.

QPERF = Internal and external quality levels.

ENVWTD = Dummy variable where:

1 = Positive weight placed on environmental performance in the bonus contract.

0 = Zero weight placed on environmental performance in the bonus contract.

QWTD = Dummy variable where:

1 = Positive weight placed on quality performance in the bonus contract.

0 = Zero weight placed on quality performance in the bonus contract.

The results presented in the first column of Table 9 show that the coefficient on the interaction of internal quality performance and a dummy variable representing positive weight on internal quality performance in the bonus contract is not significant. This result does not support H2a. The second column of Table 9 presents OLS regression results without the internal quality variables. Removal of these variables increases the sample size significantly. In this reduced model, H2a is supported for external quality performance. The interaction term EXTQPERF*EXTQWTD is positive and significant ($p < .15$). These results also show that H2b is not supported. The interaction term ENVPERF*ENVWTD is not significant. However, there is a significantly negative relationship between financial performance and the dummy variable representing positive weight on environmental performance in the bonus contract ($p < .15$).

Results: Hypothesis 4

Model 3 provides a test of the association between the use of quality and environmental performance measures in bonus contracts and financial performance. Model 3 also provides a test of H4, which predicts that there is a positive association between financial performance and the interaction between the weights on quality and environmental performance and the availability of extensive and reliable cost information.

Model 3:

$$FPERF_t = \beta_0 + \beta_1 FPERF_{t-1} + \beta_2 ENVWTSIG_t + \beta_3 QWTSIG_t + \beta_4 ENVIS_t + \beta_5 QUALIS_t + \beta_6 ENVWTSIG_t * ENVIS_t + \beta_7 QWTSIG_t * QUALIS_t$$

Where:

FPERF = Financial performance levels.

ENVWTSIG = The weight attached to environmental performance*bonus significance.

QWTSIG = The weight attached to quality performance*bonus significance.

ENVIS = Degree to which reliable environmental cost information is available.

QUALIS = Degree to which reliable quality cost information is available.

Table 10 shows the results of Model 3. These results suggest that there is a positive association between the weight on environmental performance in the bonus contract and the levels of financial performance ($p < .15$). That is, higher weight on environmental performance is associated with higher financial performance after controlling for the effects of the interaction of weight on environmental performance in the bonus contract and the availability of reliable environmental cost information. H4, however, is not supported. The coefficients on the interaction between bonus weight on quality performance and the availability of reliable quality cost information are not significant. The interaction between the weight placed on environmental performance



and the reported availability of reliable environmental cost information is negatively associated with financial performance ($p < .10$). This result implies that managers that have relatively high bonus weights on environmental performance and report high availability of reliable environmental cost information are experiencing relatively low financial performance.

CHAPTER 5

CONCLUSION

Discussion of Results⁹

This study proposes that the weight placed on quality and environmental performance in managers' bonus contracts will be positively associated with quality and environmental performance and with financial performance. The data suggest a relationship between the bonus weight placed on quality management and external quality performance. Specifically, there is a positive association between the weight placed on internal and external quality measures in the bonus contract and external quality performance levels after controlling for interactions between the weights and experiencing decreasing returns to quality investments. The corresponding associations were not found relating to either internal quality bonus weight and performance or environmental bonus weight and performance. It is interesting that internal quality bonus weight is positively associated with external quality performance levels but not internal quality performance levels. Measurement error on the internal quality performance measure could explain this result or it is possible that internal and external quality performance are related in a manner that is not captured by these models.

Tests of the data also show that there is a positive relationship between external quality performance and financial performance when weight is placed on external quality performance in the bonus contract. This association may be due to the lagged effect of

⁹ A summary of the results of tests of the hypotheses presented in this study can be found in Table 12.

past quality performance on current financial performance or due to current quality performance on current financial performance. Unfortunately, this distinction cannot be evaluated due to data limitations.

The data also reveal a positive association between bonus weight on environmental performance and financial performance levels. There is no similar relationship between the bonus weight and environmental performance, though. One possible explanation for these results is that higher financial performers can afford to shift bonus weight from financial performance to environmental performance, and do so. The effects of this shift in incentives may occur over a long time horizon and therefore are not captured in a cross-sectional study such as this.

The effects of certain institutional factors on performance were also investigated in this study. The results of the tests of these effects do not generally support the proposed hypotheses. For example, high bonus weight on environmental performance combined with high environmental cost information availability is associated with low financial performance levels. Perhaps, the hypothesized positive association cannot be captured in a short time horizon study. This result also suggests that low bonus weight on environmental performance combined with low environmental cost information availability is associated with high financial performance levels. This is counterintuitive and reveals questions for further study.

The effects of decreasing returns to investment on quality and environmental performance are not clear. On average, managers that report the existence of high levels of cost-effective and inexpensive opportunities for quality improvement combined with higher weights on quality measures in their bonus contracts manage plants with low

external quality performance levels. One interpretation of this result is that more bonus weight is placed on quality measures in bonus contracts of managers in plants that are early on in their quality improvement process. The converse would also apply. Low bonus weight is placed on quality measures in bonus contracts of managers in plants that are experiencing decreasing returns to quality investment. The non-linearity in performance measures certainly merits further attention. It is likely that the measures of non-linearity used in this study were too crude to actually capture the effects on performance and interactive effects with bonus weights particularly relating to internal quality and environmental performance. Further studies with more refined measures may find the hypothesized relationships.

Finally, the respondents in this study report that there is more weight placed on non-financial performance measures in their annual review contracts than in their bonus contracts. This further complicates the relationship between incentives and performance because annual reviews may affect overall compensation and most likely affect other career aspects that are important to managers such as promotion and reputation.

Study Limitations

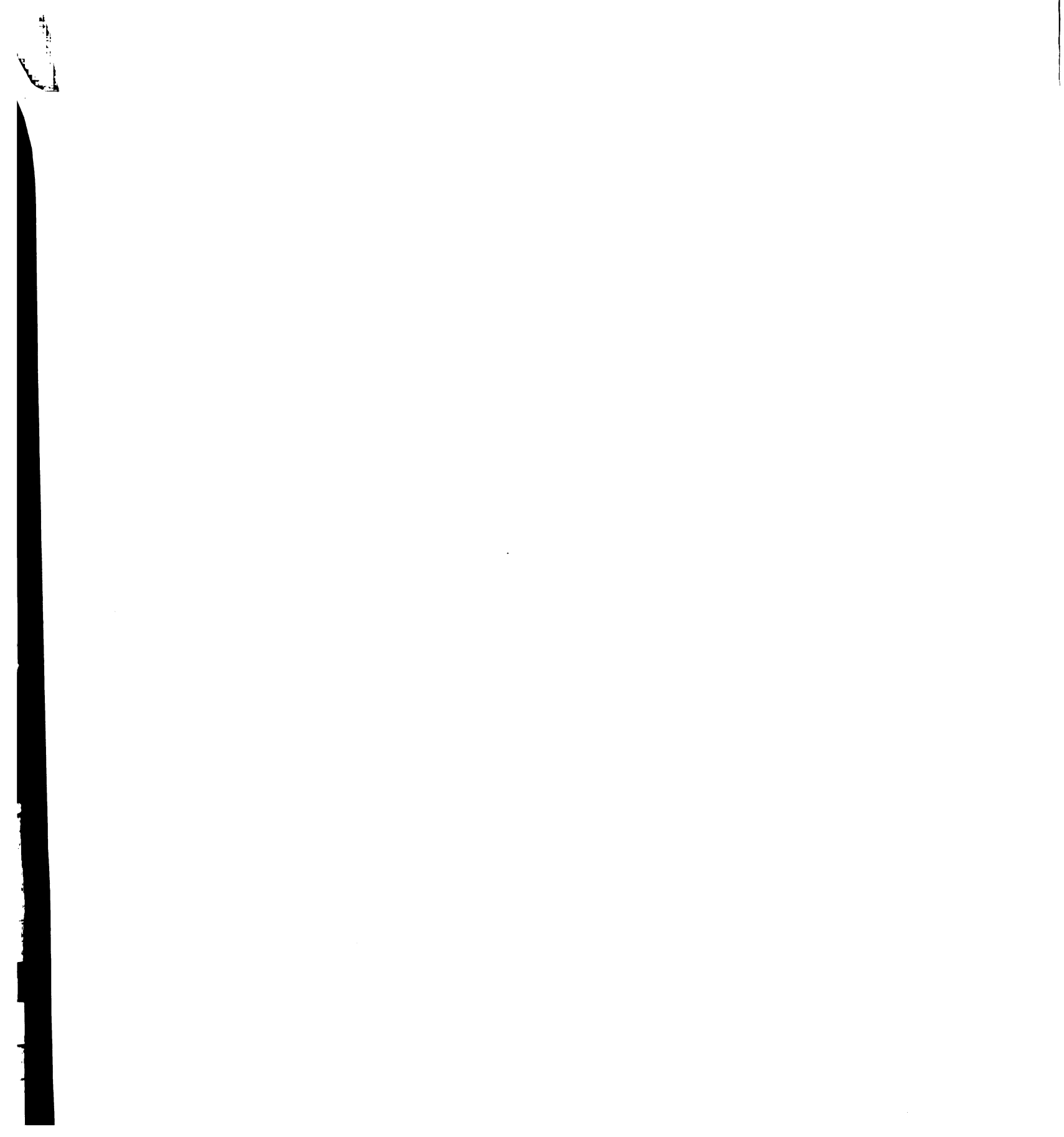
There are several limitations to this study that are worthy of discussion. First, there is considerable noise in the measurement of the dependent variables. Because the study focused on tests of hypotheses at the plant level, public quality and financial performance was not available and data sensitivity caused managers to respond to very general questions regarding this performance. Assumptions have been made regarding the cohesiveness of the responses that may not hold true. The use of a survey methodology to collect this data will probably always result in this problem. One

possible solution to this problem is to convince a single or a few companies to provide internal plant-level performance data.

The environmental performance data is public and is considered to be credible. However, this data has been normalized using a proxy for production levels that is imperfect. Also, it is not known if the TRI data used in this study is the performance measure used for the managers' bonus contracts. It is possible that the plants have internal environmental performance goals that are only marginally reflected in TRI performance.

There may also be considerable noise in the in the independent variables. The respondents were asked questions regarding cost information reliability, investment decision rights and program stage for 1999, not for the years 1997-1999. It is assumed that these institution factors are stable over that period, but that may not be the case. In retrospect, the respondents should have been asked if there was a change on these variables over the period, when, and in what direction. Incorporating this information into the model may have reduced some of the noise.

Second, the theory supporting this study has an incentive intensity component that could not be measured due to data sensitivity issues. It is highly unlikely that the respondents would have revealed the size of their bonuses or the size relative to salary. This piece of information could surely provide a clearer understanding of the effects of incentives on performance. Obtaining internal data for several plants within the same company would reduce the noise in the incentive intensity measure and might yield considerable insights into the general incentive aspects of bonuses at the plant manager level.



Further, a cross-sectional study based on survey data over a short time horizon may not be the appropriate research design to capture complex interactions. Plant level performance data over an extended period of time could provide interesting information regarding the interactions between several non-financial performance measures and between those measures and financial performance.

Finally, this study did not test for cause and effect relationships, only associations.

Contributions to the Literature and Future Research Opportunities

This study finds a positive association between the bonus weight on quality measures and external quality performance and accordingly extends the literature on the performance effects of incentives. Similar associations between bonus weight on quality measures and internal quality performance and between bonus weight on environmental measures and environmental performance were not found in this study. The study has contributed to this literature stream in other ways, though. It investigates the issue at the plant manager level rather than the CEO level as in most previous studies. This provides the ability to identify the weights used in the bonus contracts and to specifically test the relationships between those weights and performance. The study has also provided insight into the design of plant managers' bonus and performance review contracts. It has also raised interesting issues regarding the effect of the composition of performance review contracts and performance that are worthy of further investigation. It may also prove interesting to try to determine why these two sets of contracts are designed to place different weights on the same measures.

The study has also expanded the literature on the performance effects of incentives by examining the relationship between bonus weights and environmental

performance as well as quality performance. Little is known about the factors that affect voluntary pollution reduction and this study provides a basis for discussing measurement issues as well as arguments and theory regarding what factors might affect environmental performance. Further investigations into how firms manage environmental risks, performance goals and costs should enhance our understanding of the relationship between environmental incentives and performance.

This study has attempted to incorporate the non-linear relations between incentives and non-financial performance into a performance model with limited success. The results indicate that, however difficult it may be, further research is needed on the non-linear relations between incentives and both non-financial and financial performance. This study also included two contingency factors that are expected to affect performance. The lack of results regarding the association between performance and the amount of reliable cost information available or capital investment decision rights suggest that refinements to these measures will likely be required. It is very difficult to determine what constitutes good cost information. Perhaps, extensive discussions with managers across several industries would provide insights into alternative measures of this variable.

It may not be true that greater control over capital investment decision making will lead to higher performance. For example, investment decision making at the corporate level may be (and probably should be) perfectly in line with the incentives offered to plant managers. Further research could address how to determine whether this is the case within organizations and how to measure the performance effects of this alignment.

TABLE 1 (Panel A)

Principal Components Analysis
Factor Loadings After Oblique Rotation

Factor	SIG	QPOS1	QPOS2	EPOS1	EPOS2
Question 1	.64534				
Question 2	.76532				
Question 3	.68728				
Question 1		.77153	.10234		
Question 2		.77213	.17265		
Question 3		.26460	.39752		
Question 4		.13978	.39503		
Question 1				.84618	.23722
Question 2				.85542	.12727
Question 3				.16921	.51792
Question 4				.07070	.48656

TABLE 1 (Panel B)

Factor	QUALIS	ENVIS	QUALCB	ENVCB
Question 1	.68373			
Question 2	.68037			
Question 3	.53749			
Question 4	.61604			
Question 1		.64334		
Question 2		.57546		
Question 3		.36896		
Question 4		.64851		
Question 5		.49081		
Question 1			.56782	
Question 2			.65442	
Question 3			.66369	
Question 4			.44513	
Question 1				.38607
Question 2				.33832
Question 3				.64972
Question 4				.66069
Question 5				.45123

Variables are defined in Table 11.

TABLE 2
Descriptive Statistics of Independent Variable Factors
(n=117)

Factor	Cronbach Alpha	Mean	S.D.	Actual Range	Theoretical Range
SIG	.74	4.172	1.269	1 – 6	1 - 6
QPOS1	.82	4.333	1.235	1.5 – 6	1 - 6
QPOS2	.48	3.564	1.106	1 - 6	1 - 6
EPOS1	.90	3.197	1.417	1 – 6	1 - 6
EPOS2	.57	4.385	1.090	1 – 6	1 - 6
QUALIS	.89	3.694	1.058	1.5 – 6	1 - 6
ENVIS	.79	3.506	0.954	1 – 6	1 - 6
QUALCB	.71	3.985	0.914	1.25 – 6	1 - 6
ENVCB	.64	3.875	1.057	1 – 6	1 – 6

Variables are defined in Table 11.

TABLE 3

Ex Ante Expectations of the Weight Placed on Various Financial and Non-Financial Performance Measures in the Managers' Annual Performance Review

Mean Weight
(Standard Deviation)

	SIC 25 Furniture	SIC 26 Paper	SIC 28 Chemicals	SIC 30 Plastic	Total
Plant Financial Performance	.327 (.213)	.404 (.440)	.166 (.140)	.404 (.210)	.270 (.282)
Firm Financial Performance	.124 (.183)	.058 (.087)	.086 (.165)	.054 (.107)	.084 (.151)
Cost Control	.133 (.113)	.134 (.090)	.173 (.106)	.130 (.122)	.153 (.106)
Other Financial Performance	.027 (.060)	.020 (.084)	.019 (.034)	.017 (.028)	.021 (.055)
Cycle Time Management	.037 (.060)	.003 (.014)	.024 (.044)	.011 (.018)	.021 (.043)
Safety	.064 (.110)	.156 (.105)	.193 (.115)	.121 (.069)	.151 (.118)
Quality Management	.067 (.080)	.107 (.062)	.090 (.067)	.104 (.095)	.090 (.072)
Customer Satisfaction	.137 (.144)	.076 (.065)	.106 (.090)	.097 (.072)	.104 (.099)
Environmental Performance	.041 (.056)	.064 (.063)	.107 (.080)	.043 (.046)	.079 (.075)
Other Non-Financial Perf.	.043 (.067)	.033 (.053)	.037 (.060)	.013 (.021)	.036 (.058)
N	62	74	147	23	306

TABLE 4

Ex Ante Expectations of the Weight Placed on Various Financial and Non-Financial Performance Measures in the Managers' Annual Bonus

Mean Weight
(Standard Deviation)

	SIC 25 Furniture	SIC 26 Paper	SIC 28 Chemicals	SIC 30 Plastic	Total
Plant Financial Performance	.306 (.282)	.403 (.331)	.180 (.018)	.559 (.337)	.287 (.285)
Firm Financial Performance	.293 (.331)	.257 (.288)	.332 (.275)	.115 (.156)	.290 (.289)
Cost Control	.099 (.137)	.076 (.123)	.122 (.283)	.055 (.104)	.102 (.217)
Other Financial Performance	.033 (.101)	.019 (.084)	.022 (.058)	.090 (.150)	.029 (.085)
Cycle Time Management	.000 (.000)	.003 (.030)	.013 (.034)	.004 (.010)	.007 (.028)
Safety	.035 (.107)	.010 (.118)	.139 (.134)	.040 (.062)	.101 (.128)
Quality Management	.037 (.085)	.048 (.073)	.057 (.070)	.166 (.334)	.059 (.119)
Customer Satisfaction	.064 (.123)	.033 (.050)	.059 (.104)	.013 (.021)	.050 (.095)
Environmental Performance	.003 (.012)	.021 (.041)	.071 (.082)	.007 (.016)	.041 (.068)
Other Non-Financial Perf.	.032 (.130)	.041 (.111)	.027 (.084)	.010 (.023)	.031 (.099)
N	62	74	149	23	308

TABLE 5
Descriptive Statistics of Regression Variables

	Unit Measure	Mean	Standard Deviation	Plant-Year N
ENVWTSIG	% weight*bonus significance	.172	.311	309
EXTQWTSIG	% weight*bonus significance	.217	.486	309
INTQWTSIG	% weight *bonus significance	.230	.470	309
QPOS1	Range 1 - 6	4.337	1.242	312
QPOS2	Range 1 - 6	3.551	1.091	312
EPOS1	Range 1 – 6	3.187	1.424	313
EPOS2	Range 1 – 6	4.359	1.076	312
QUALIS	Range 1 – 6	3.735	1.046	312
ENVIS	Range 1 – 6	3.502	.937	311
QUALCB	Range 1 - 6	4.028	.893	307
ENVCB	Range 1 – 6	3.900	1.003	309
ENVLEVEL	Lbs. of emissions per employee	3292.628	8118.296	395
EXTQLEVEL	Unknown	89.517	14.185	351
INTQLEVEL	Unknown	4.586	3.448	240
FPLEVEL	Unknown	11.080	8.593	309

Variables are defined in Table 11.

TABLE 6

OLS regression of internal quality performance levels on bonus weights on quality performance measures, returns to quality investments, and quality decision rights
Test of H1a, H3a and H5a

	Coefficient (t-statistic)	
INTQPERF _{t-1} (+)	.79 (8.84)***	0.80 (9.30)***
INTQWTSIG (+)	-.21 (-0.07)	.08 (0.45)
EXTQWTSIG (+)	4.81 (2.24)**	.17 (0.56)
QPOS1 (+)	.04 (0.32)	.05 (0.35)
QPOS1*INTQWTSIG (+)	.03 (0.08)	
QPOS1*EXTQWTSIG (+)	-.18 (-0.53)	
QPOS2 (+)	.43 (0.99)	.30 (1.14)
QPOS2*INTQWTSIG (+)	-.26 (-0.48)	
QPOS2*EXTQWTSIG (+)	-.71 (-1.40)	
QUALCB (+)	.06 (0.24)	.08 (0.55)
QUALCB*INTQWTSIG (+)	.28 (.25)	
QUALCB*EXTQWTSIG (+)	-.26 (-0.99)	
AGE (+)	-.01 (-0.41)	-.00 (-0.22)
CONSTANT	-2.38 (-1.60)*	-2.02 (-1.54)*
R ²	.67	.67
N	159	159

***, **, * and # = significant at less than 0.01, 0.05, 0.10 and 0.15 levels (one-tailed), respectively.

The second column presents OLS regression results omitting insignificant interactions. Variables are defined in Table 11.

TABLE 7

OLS regression of external quality performance levels on bonus weights on quality performance measures, returns to quality investments, and quality decision rights
Test of H1a, H3a and H5a

	Coefficient (t-statistic)	
EXTQPERF _{t-1} (+)	.85 (18.00)***	.84 (18.12)***
INTQWTSIG (+)	-.55 (-0.08)	4.52 (2.15)**
EXTQWTSIG (+)	1.49 (0.43)	2.12 (2.49)*
QPOS1 (+)	-.61 (-1.97)**	-.45 (-1.97)**
QPOS1*INTQWTSIG (+)	.49 (0.85)	
QPOS1*EXTQWTSIG (+)	.29 (0.49)	
QPOS2 (+)	1.08 (3.14)***	1.05 (3.16)***
QPOS2*INTQWTSIG (+)	-1.38 (-2.82)**	-1.27 (-2.54)***
QPOS2*EXTQWTSIG (+)	-.77 (1.75)*	-.94 (-2.59)***
QUALCB (+)	-.04 (-0.09)	-.04 (-0.08)
QUALCB*INTQWTSIG (+)	.71 (0.67)	
QUALCB*EXTQWTSIG (+)	-.27 (-0.62)	
AGE (-)	-.14 (-3.29)***	-.13 (-3.36)***
CONSTANT	18.04 (3.92)***	17.29 (3.85)***
R ²	.89	.89
N	234	234

***, **, * and # = significant at less than 0.01, 0.05, 0.10 and 0.15 levels (one-tailed), respectively.

The second column presents OLS regression results omitting insignificant interactions. Variables are defined in Table 11.

TABLE 8

OLS regression of environmental performance levels on bonus weight on environmental performance measures, returns to environmental investments, and environmental decision rights

Test of H1b, H3b and H5b

	Coefficient (t-statistic)	
ENVPERF _{t-1} (+)	.95 (17.66)***	.95 (19.80)***
ENVWTSIG (+)	-6535.87 (-1.11)	-1770.76 (-1.27)
EPOS1 (+)	-78.61 (-0.80)	124.52 (0.99)
EPOS1*ENVWTSIG (+)	1080.92 (1.22)	
EPOS2 (+)	132.54 (0.83)	-81.59 (-.48)
EPOS2*ENVWTSIG (+)	-1287.53 (-1.04)	
ENVCB (+)	-230.96 (1.90)*	-92.97 (0.69)
ENVCB*ENVWTSIG (+)	1386.14 (1.04)	
AGE (+)	4.20 (0.29)	12.21 (0.68)
CONSTANT	638.48 (0.81)	-43.62 (-0.51)
R ²	.84	.83
N	270	270

***, **, * and # = significant at less than 0.01, 0.05, 0.10 and 0.15 levels (one-tailed), respectively.

The second column presents OLS regression results omitting insignificant interactions. Variables are defined in Table 11.

2

1

TABLE 9

OLS regression of financial performance on the use of bonus weights on non-financial performance and non-financial performance
Tests of H2a and H2b

	Coefficient (t-statistic)	
FPERF _{t-1} (+)	.88 (16.42)***	.85 (22.59)***
ENVPERF (+)	-.0003 (-2.11)**	.00 (0.09)
ENVWTD (+)	.29 (0.31)	-1.12 (-1.44)#
ENVPERF*ENVWTD (+)	.0003 (2.10)**	-.00 (-0.30)
INTQPERF (+)	.05 (0.60)	
INTQWTD (+)	-.54 (-0.57)	
INTQPERF*INTQWTD (+)	.18 (0.77)	
EXTQPERF (+)	.03 (1.04)	.01 (0.78)
EXTQWTD (+)	17.9 (1.88)**	-9.06 (-1.26)
EXTQPERF*EXTQWTD (+)	-.19 (-1.85)**	.11 (1.39)#
CONSTANT	-.31 (-0.24)	.93 (1.87)
R ²	.83	.79
N	116	190

***, **, * and # = significant at less than 0.01, 0.05, 0.10 and 0.15 levels (one-tailed), respectively.

The second column presents OLS regression results omitting insignificant internal quality measures.

Variables are defined in Table 11.

TABLE 10

OLS regression of bonus weight on quality and environmental performance measures
levels and availability of reliable quality and environmental cost information on financial
performance
Test of H4

Coefficient
(t-statistic)

FPERF _{t-1} (+)	.90 (27.35)***	.90 (27.75)***
ENVWTSIG (+)	11.04 (1.51)#	10.72 (1.58)#
INTQWTSIG (+)	-2.22 (-1.05)	.21 (0.56)
EXTQWTSIG (+)	-2.17 (-0.54)	.72 (0.95)
ENVIS (+)	.18 (0.66)	.19 (0.70)
QUALIS (+)	.28 (0.70)	.33 (0.90)
ENVWTSIG*ENVIS (+)	-2.81 (-1.46)#	-2.78 (-1.62)*
INTQWTSIG*QUALIS (+)	.60 (1.19)	
EXTQWTSIG*QUALIS (+)	-.46 (-0.67)	
CONSTANT	-.67 (-0.42)	-.88 (-0.59)
R ²	.81	.81
N	216	216

***, **, * and # = significant at less than 0.01, 0.05, 0.10 and 0.15 levels (one-tailed), respectively.

The second column presents OLS regression results omitting insignificant interactions. Variables are defined in Table 11.

TABLE 11
Variable Definitions

- SIG – the self-reported significance of the bonus to each manager.
- ENVWTSIG – the weight attached to environmental performance in the bonus contract * bonus significance.
- EXTQWTSIG – the weight attached to external quality performance in the bonus contract * bonus significance.
- INTQWTSIG – the weight attached to internal quality performance in the bonus contract * bonus significance.
- QPOS1 – Inexpensive and cost-effective opportunities for product quality improvements exist. A stage measure.
- QPOS2 – Experiencing or expecting to experience decreasing returns to quality investment. A stage measure.
- EPOS1 – Inexpensive and cost-effective opportunities for environmental improvements exist. A stage measure.
- EPOS2 – Experiencing or expecting to experience decreasing returns to environmental Investment. A stage measure.
- QUALIS – The availability of reliable and useful quality cost information.
- ENVIS – The availability of reliable and useful environmental cost information.
- QUALCB – The ability to control quality capital budgeting decisions.
- ENVCB – The ability to control environmental capital budgeting decisions.
- ENVPERF – The annual levels of TRI emissions scaled by number of full-time equivalent employees.
- EXTQPERF – The self-reported performance level on each plant's most important measure of external quality performance.
- INTQPERF – The self-reported performance level on each plant's most important measure of internal quality performance.
- FPERF – The self-reported performance level on each plant's most important measure of financial performance.
- ENVWTD = Dummy variable where:
- 1 = Positive weight placed on environmental performance in the bonus contract.
 - 0 = Zero weight placed on environmental performance in the bonus contract.
- INTQWTD = Dummy variable where:
- 1 = Positive weight placed on internal quality performance in the bonus contract.
 - 0 = Zero weight placed on internal quality performance in the bonus contract.
- EXTQWTD = Dummy variable where:
- 1 = Positive weight placed on external quality performance in the bonus contract.
 - 0 = Zero weight placed on external quality performance in the bonus contract.
- AGE – The self-reported age of the plant.

Table 12

Table of Results

Hypotheses
Results

H1a: There is a positive association between the weight placed on quality performance in the annual bonus contract and quality performance.
H1b: There is a positive association between the weight placed on environmental performance in the annual bonus contract and environmental performance.
Results: H1a is partially supported. There is a positive association between external quality performance levels and the weight placed on internal quality performance measures ($p < .05$) and external quality performance measures ($p < .10$). H1b is not supported.
H2a: There is a positive association between financial performance and quality performance when weight is placed on quality performance measures in annual bonus contracts.
H2b: There is a positive association between financial performance and environmental performance when weight is placed on environmental performance measures in annual bonus contracts.
Results: H1a is partially supported. There is a positive association between external quality performance and financial performance when weight is placed on external quality performance in the bonus contract. H2b is not supported.
H3a: The weight placed on quality performance measures in annual bonus contracts will have a more positive effect on quality performance when marginal returns to investment are experienced.
H3b: The weight placed on environmental performance measures in annual bonus contracts will have a more positive effect on environmental performance when marginal returns to investment are experienced.
Results: H3a is not supported. There is a negative association between external quality performance and the interactions between internal and external quality measures in the bonus contract and perceived decreasing returns to investment ($p < .01$) for both. H3b is not supported
H4a: The weight on quality performance measures in annual bonus contracts will have a more positive effect on quality performance when reliable quality cost information is available.
H4b: The weight on environmental performance measures in annual bonus contracts will have a more positive effect on environmental performance when reliable environmental cost information is available.

Table 12
(Continued)

Table of Results

Hypotheses
Results

Results: H4a and H4b are not supported. Tests of H4b show that there is a negative association between the interaction of the weight placed on environmental performance in the bonus contract and the availability of reliable environmental cost information and financial performance.
H5a: The weight placed on quality performance measures in annual bonus contracts will have a more positive effect on quality performance when capital investment decision rights can be exercised.
H5b: The weight placed on environmental performance measures in annual bonus contracts will have a more positive effect on environmental performance when capital investment decision rights can be exercised.
Results: H5a and H5b are not supported.

APPENDIX A

Survey Cover Letter Example

Date

Name/Production Manager
Title Associated with Name
Company
Address

Dear Name or Sir/Madam:

APICS-The Educational Society for Resource Management and Michigan State University are supporting a survey regarding the effects of compensation design and information and decision making systems on operational performance. Your participation in the project will ensure that your experiences as a manager are included in a study that should provide important insight into the areas of compensation design and non-financial performance measurement. You will have access to a summary benchmark report when all responses have been received and analyzed.

The survey has been enclosed with this letter. Managers that have tested the questionnaire reported that it required about twenty minutes of their time to complete the survey. The also reported that the survey was easy to follow and that the questions were not too difficult to answer.

Individual responses to this survey will be kept strictly confidential. The responses will be aggregated and analyzed in order to create a report of current practices. This benchmarking report will allow you to compare your facility by industry and against best practice. If you would like a copy of the report to be sent to you, please attach your business card to the last page of the survey.

If you have any questions about the survey, please contact me at (517) 353-8754 or at connorse@pilot.msu.edu. Questions regarding the commitment of Michigan State University toward protection of the rights and privacy of research participants may be directed to David Wright at the Office of Research and Graduate Studies, (517) 355-2180. Thank you in advance for your participation in this project.

Sincerely,

Elizabeth Connors
Research Principal

Enclosure

APPENDIX B

Sample Research Project Support Letter

APICS Educational & Research Foundation, Inc.
5301 Shawnee Road
Alexandria, VA 22312-2317

Date

Dear Valued Colleague:

On behalf of the APICS Educational and Research Foundation, I am asking for your support and assistance in helping to complete an important business research project. Michigan State University is conducting a survey of the chemical, furniture and paper industries in order to evaluate the effects of compensation design on financial and non-financial performance at the plant level.

Effective compensation design is a very important issue facing management at all organizational levels. The issue is complex and there are many theories proposed by consultants and academics that have yet to be tested. This research project proposes to determine the types of compensation design used at the plant management level and to establish a relationship between the designs and plant-level financial and non-financial performance. We believe that this is very important research because it will provide a test of current executive compensation theory and will allow firms to see where they stand on this issue relative to their compensation.

We strongly encourage you to participate in this important research. We have reviewed the survey and the overall methodology, and we find them to be of sound business research practice. All individual responses will be kept confidential and all results will be reported in the aggregate. As noted at the end of the survey, you may request a copy of the results, which could be useful for benchmarking the effects of your firm's compensation plans on financial and non-financial performance relative to your competitors.

If you have any questions about APICS involvement in this research, or how APICS can serve you, please call me at (800) 444-2742. For questions about the survey itself, please contact Elizabeth Connors at (517) 353-8754 or connorse@pilot.msu.edu.

Thank you very much for your time and attention. We hope that you are looking forward to the results of the survey as much as we are at APICS.

Sincerely,

Mike Lithgoe
Director

APPENDIX C
Survey Instrument

The Effects of Managers' Compensation Design
Michigan State University
The Eli Broad Graduate School of Management
East Lansing, Michigan

This survey is part of a study that examines how the design of managerial compensation relates to firm characteristics. The differences between the structures of compensation plans of individual plant managers and the corresponding financial and non-financial outcomes are of primary importance in the study. Other plants in your industry (chemical, furniture, paper, plastic, and rubber) are also participating and the importance of your response cannot be overemphasized. Aggregate results of this study will be provided in a benchmark report to APICS-The Educational Society for Resource Management and to you, if you so wish.

Your careful consideration of all of the questions in this survey will provide a comprehensive understanding of the practices used and outcomes experienced by your plant. Please answer the questions as accurately and completely as possible.

The survey covers the period 1996 – 1999. Please complete the survey for the years that you have held your position as manager of this plant or have the appropriate information about the previous manager in your position.

Two non-financial performance measures are stressed in this survey. The first is *product quality* and the second is *voluntary pollution reduction*. For the purposes of this study, voluntary pollution reduction efforts are those that are not motivated by regulations that are currently in effect. Thus, efforts to comply in advance of future regulations are considered to be voluntary.

**ALL INDIVIDUAL RESPONSES WILL BE KEPT STRICTLY CONFIDENTIAL
AND ONLY SUMMARY RESULTS WILL BE REPORTED.**

If you have any questions or concerns, please feel free to contact:

Elizabeth Connors
Michigan State University
N250 North Business Complex
East Lansing, MI 48824
Tel.: (517) 353-8754
Fax.: (517) 432-1101
E-Mail: connorse@pilot.msu.edu

Thank you for your time and attention.

Section A: Compensation Structure

Before your review, what did you think would be the weight placed on the following measures in your annual performance review?

	<u>1999</u>	<u>1998</u>	<u>1997</u>
Plant-level financial performance	_____	_____	_____
Firm-level financial performance	_____	_____	_____
Cost control	_____	_____	_____
Other financial performance	_____	_____	_____
Cycle time management	_____	_____	_____
Safety	_____	_____	_____
Quality management	_____	_____	_____
Customer satisfaction	_____	_____	_____
Environmental performance	_____	_____	_____
Other non-financial performance	_____	_____	_____
Total	<u>100 %</u>	<u>100 %</u>	<u>100%</u>

Before your review, what did you think would be the weight placed on the following measures in determining your annual bonus?

	<u>1999</u>	<u>1998</u>	<u>1997</u>
Plant-level financial performance	_____	_____	_____
Firm-level financial performance	_____	_____	_____
Cost control	_____	_____	_____
Other financial performance	_____	_____	_____
Cycle time management	_____	_____	_____
Safety	_____	_____	_____
Quality management	_____	_____	_____
Customer satisfaction	_____	_____	_____
Environmental performance	_____	_____	_____
Other non-financial performance	_____	_____	_____
Total	<u>100 %</u>	<u>100 %</u>	<u>100%</u>

Scale points are completely disagree (1), disagree (2), tend to disagree (3), tend to agree (4), agree (5), and completely agree (6).

	completely disagree			completely agree		
My bonus is a significant portion of my compensation package.	1	2	3	4	5	6
Achieving my bonus is important to me	1	2	3	4	5	6
The structure of my bonus affects my decisions	1	2	3	4	5	6

Please circle your estimate of how much of the volatility of your bonus is due to plant-level factors that are out of your control:

0-20% 21-40% 41-60% 61-80% 81-100%

Section B: Position in Processes

Scale points are completely disagree (1), disagree (2), tend to disagree (3), tend to agree (4), agree (5), and completely agree (6).

At our plant:

	completely disagree			completely agree		
Inexpensive opportunities for product quality improvement exist.	1	2	3	4	5	6
Cost-effective opportunities for product quality improvement exist.	1	2	3	4	5	6
In the future it will be more costly to achieve a given level of product quality improvement than it has in the past.	1	2	3	4	5	6
Our quality efforts yield diminishing returns.	1	2	3	4	5	6
Inexpensive opportunities for pollution reduction exist.	1	2	3	4	5	6

Section B: Position in Processes

Scale points are completely disagree (1), disagree (2), tend to disagree (3), tend to agree (4), agree (5), and completely agree (6).

At our plant:

	completely disagree			completely agree		
Cost-effective opportunities for pollution reduction exist.	1	2	3	4	5	6
In the future it will be more costly to achieve a given level of pollution reduction than it has in the past.	1	2	3	4	5	6
Our pollution reduction efforts yield diminishing returns.	1	2	3	4	5	6

Please indicate the approximate levels of your most important measure of *external quality* performance (e.g. delivery times, customer satisfaction, defective parts per million at final inspection):

For example: A score of 95% on customer satisfaction measures would be a **level** of 95. A score of 95% on delivery time would also be a **level** of 95.

Note: We do not need to know the type of performance measure that you use. We are only asking for the **levels** of your most important measure.

	<u>Improvement over Measurement previous year?</u>	<u>Did the method change?</u>
Levels for 1999 _____	_____ Yes _____ No	_____ Yes _____ No
Levels for 1998 _____	_____ Yes _____ No	_____ Yes _____ No
Levels for 1997 _____	_____ Yes _____ No	_____ Yes _____ No
Levels for 1996 _____		

Please indicate the approximate levels of your most important measure of *internal quality performance* (eg. scrap rates, prime rates, rework rates) :

For example: A scrap rate of 4% would be a **level** of 4. A rework rate of 4% would also be a **level** of 4.

Note: We do not need to know the type of performance measure that you use. We are only asking for the **levels** of your most important measure.

	<u>Improvement over measurement previous year?</u>	<u>Did the method change?</u>
Levels for 1999 _____	_____ Yes _____ No	_____ Yes _____ No
Levels for 1998 _____	_____ Yes _____ No	_____ Yes _____ No
Levels for 1997 _____	_____ Yes _____ No	_____ Yes _____ No
Levels for 1996 _____		

What is the status of the following programs within your plant?

Please place an "X" in one cell per program.

	Not Being Considered	Assessing Suitability	Planning to Implement	Currently Implementing(ed)	Success- fully
ISO/QS 9000					
Total Quality Management					
Company-specific Environmental Management System					
ISO 14000					

Section C: Information Systems

Scale points are completely disagree (1), disagree (2), tend to disagree (3), tend to agree (4), agree (5), and completely agree (6).

At our plant:

	completely disagree			completely agree		
It is easy to relate quality efforts directly to production cost reductions.	1	2	3	4	5	6
I can easily determine the financial cost of quality related process and product changes.	1	2	3	4	5	6
I know substantially all of the financial effects of quality-related decisions.	1	2	3	4	5	6
Our cost-of-quality information is reliable and useful for decision making.	1	2	3	4	5	6
It is easy to relate pollution reduction efforts directly to production cost reductions.	1	2	3	4	5	6
It is easy to relate pollution reduction efforts directly to reduced future compliance costs.	1	2	3	4	5	6
I can easily determine the financial <i>cost</i> of pollution reduction related <i>process</i> and <i>product</i> changes.	1	2	3	4	5	6
I can easily determine the financial <i>benefits</i> of pollution reduction related <i>process</i> and <i>product</i> changes.	1	2	3	4	5	6
Our environmental cost information is reliable and useful for decision making.	1	2	3	4	5	6

Section D: Capital Budgeting Practices

Scale points are completely disagree (1), disagree (2), tend to disagree (3), tend to agree (4), agree (5), and completely agree (6).

At our plant:

	completely disagree				completely agree	
Product quality investments compete on a plant-wide basis for funds based on financial factors only.	1	2	3	4	5	6
Both financial and non-financial factors are given weight in product quality investment decisions.	1	2	3	4	5	6
Non-financial factors are heavily weighted in product quality investment decisions.	1	2	3	4	5	6
I have a great deal of control over product quality investment choices.	1	2	3	4	5	6
We are more likely to invest in quality improvement projects during times of good financial performance.	1	2	3	4	5	6
Quality performance depends on financial performance.	1	2	3	4	5	6
Financial performance depends on quality performance.	1	2	3	4	5	6
<i>Voluntary</i> environmental investments compete on a <u>company-wide</u> basis for funds based on financial factors only.	1	2	3	4	5	6
<i>Voluntary</i> environmental investments compete on a <u>plant-wide</u> basis for funds based on financial factors only.	1	2	3	4	5	6
Both financial and non-financial factors are given weight in <i>voluntary</i> environmental investment decisions.	1	2	3	4	5	6
Non-financial factors are heavily weighted in <i>voluntary</i> environmental investment decisions.	1	2	3	4	5	6



Scale points are completely disagree (1), disagree (2), tend to disagree (3), tend to agree (4), agree (5), and completely agree (6).

At our plant:

	completely disagree				completely agree		
I have a great deal of control over <i>voluntary</i> environmental investment choices.	1	2	3	4	5	6	
We are more likely to invest in <i>voluntary</i> pollution reduction projects during times of good financial performance.	1	2	3	4	5	6	
<i>Voluntary</i> environmental performance depends on financial performance.	1	2	3	4	5	6	
Financial performance depends on <i>voluntary</i> environmental performance.	1	2	3	4	5	6	

Section E: Plant Characteristics and Management Information

What is the average age of your plant's production equipment? _____ years.

Is your plant considered to be (please check one):

- A profit center _____
- A cost center _____
- Other _____ (please describe) _____

Please indicate the approximate levels of your most important measure of *financial* performance (eg. Return on Assets, Return on Assets Employed, Total Costs):

For example: A 7% Return on Assets Employed would be a **level** of 7. A cost reduction of 7% would also be a **level** of 7.

Note: We do not need to know the type of performance measure that you use. We are only asking for the **levels** of your most important measure.

	<u>Improvement over previous year?</u>	<u>Did the measurement method change?</u>
Levels for 1999 _____	_____ Yes _____ No	_____ Yes _____ No
Levels for 1998 _____	_____ Yes _____ No	_____ Yes _____ No
Levels for 1997 _____	_____ Yes _____ No	_____ Yes _____ No
Levels for 1996 _____		

Please indicate the approximate number of full-time equivalent employees:

during 1999	_____
during 1998	_____
during 1997	_____
during 1996	_____

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