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MANAGERS' RESOURCE ALLOCATION: REVIEW AND IMPLICATIONS FOR FUTURE RESEARCH

C. Janie Chang
San Jose State University

Joanna L. Y. Ho
University of California at Irvine

Ping Lin
University of California at Irvine

1.0 INTRODUCTION

This paper has three main objectives: (1) to provide a framework that can be used to categorize and assess research in resource allocation; (2) to review and synthesize prior experimental research in resource allocation within this framework; and (3) to identify and discuss directions for future research that would enhance our understanding of how managerial accounting theory and practice affect managers' resource allocation.

Resource allocation decisions are important because of their impact on a firm's value [Merchant 1997]. The decisions can be broadly categorized as routine or non-routine. Non-routine decisions are characterized by high risk, uncertainty, and infrequent feedback. Accordingly, non-routine decisions are more likely to be influenced by the decision maker's knowledge, experience, and cognitive characteristics, as well as by organizational and social environmental factors.[1]

Although theoretical frameworks on resource allocation exist [e.g., Brockner 1992; Staw 1997; Staw and Ross 1987], they focus mainly on ongoing projects and on escalation behavior.[2] Our proposed framework expands on these previous models by including factors affecting both new and ongoing projects. It also adds factors that are particularly important to managerial resource allocation. Specifically, we discuss project-related factors (e.g., payoffs

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[1] Routine resource allocation decisions refer to those that require frequent allocation of limited resources among competing alternatives (e.g., managers may allocate fuel and personnel time to two operating machines to maximize the production output) [Langholtz et al. 1997; Langholtz, Gettys and Foote 1993]. Further, routine resource allocations involve repeated observations, frequent feedback, and low uncertainty. They also rely on statistical or mathematical techniques such as linear programming. Our review does not extend to routine resource allocations.

[2] Escalation behavior refers to an attempt to recoup losses by allocating additional resources to ongoing projects experiencing a financial setback.

and likelihood of cash flows, opportunity costs, and cost measurement), decision makers' characteristics (e.g., knowledge, academic training, domain-specific experience, and cognitive characteristics) and the managerial environment (e.g., performance evaluation systems, information asymmetry between superiors and subordinates, and managers' job mobility and security).

The remainder of this paper consists of four sections. Section 2 describes the framework we use for the literature analysis and synthesis. It also reviews prior studies and evaluates how future research might extend the insights from these studies. Our review includes relevant non-accounting studies to emphasize the inter-disciplinary nature of resource allocation decisions and because prior research has shown that many results related to human judgments and decisions in psychology and management can be generalized to accounting [e.g., Bonner et al. 2000; Shields 1997]. Section 3 presents the effects of feedback on managers' resource allocation. Section 4 summarizes our main points and provides concluding comments.

2.0 THEORETICAL FRAMEWORK AND REVIEW OF EMPIRICAL RESEARCH

Figure 1 presents the framework that we use to analyze and synthesize the literature. The framework suggests that project-related factors, decision maker-related factors, and environment-related factors affect managers' resource allocation judgments[3] (e.g., the outcome of each alternative under foreseeable future conditions, likelihood judgment of events/conditions, and overall likelihood judgment on the success of each decision alternative). These judgments constitute the input to a manager's utility/preference function, which forms the basis for a manager to decide on an alternative that yields the highest utility. Based on their earlier judgments and other considerations (e.g., social and political), managers make resource allocation decisions as to whether to initiate/continue a project and the amount/level of resources to put into the project. After carrying out a project, the outcome of the project provides managers with feedback to use in reassessing whether to allocate additional resources to the project or to discontinue it.

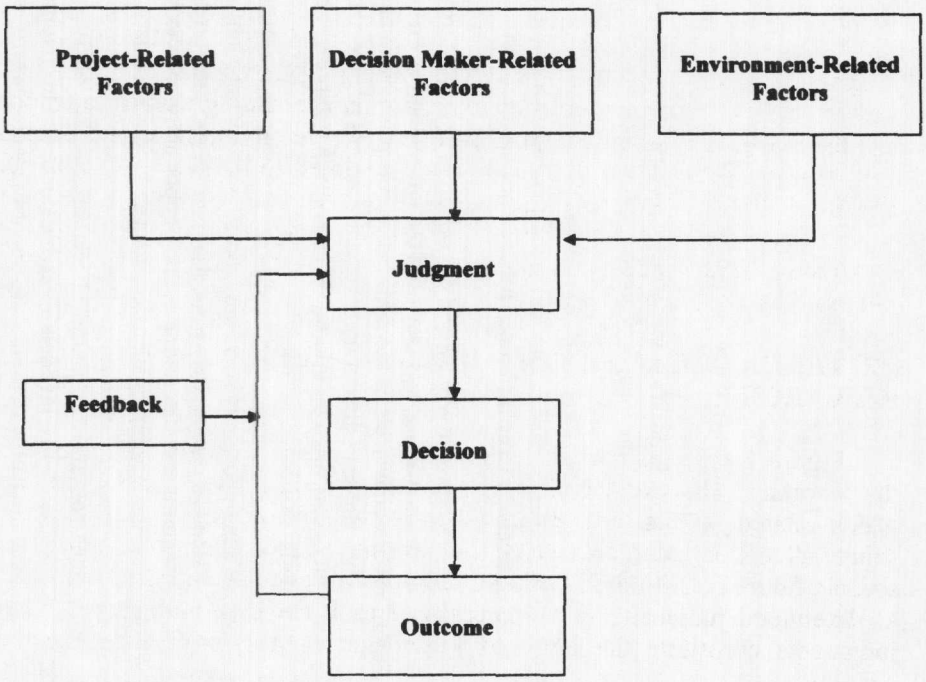
2.1 Project-Related Factors

Managers' resource allocation judgments are affected by quantitative and qualitative aspects of the projects [Chan and Lynn 1993; Cheung 1993; Farazmand and Neill 1996; Hellings 1985]. Based on an extensive literature review, we delineate the following four quantitative aspects of projects: payoffs and likelihood of cash flows; opportunity costs; cost measurement; and investment mode. In addition, resource allocation decisions can be affected by

[3] In general, judgments involve inferences, analysis, and evaluation of information, while decisions are choices that are made based on judgment [Hogarth 1987].

Figure 1

Resource Allocation Judgment/Decision Framework



qualitative factors that cannot be easily or objectively translated into quantitative terms. Table 1 provides a summary of selected studies addressing project-related factors.

2.1.1 Quantitative Factors Payoffs and Likelihood of Cash Flows

Various studies show that managers use cash flow analyses to evaluate the prospects of a project and whether to allocate resources to that project. Typical benchmarks used in these analyses include internal rate of return, net present value, accounting rate of return, or payback period [Chen 1995; Cheng, Kite and Radtke 1994; Cummins 1990; Luehrman 1998; Pike 1996]. Empirical evidence suggests that managers with no incentive to shirk tend to invest in projects with higher or positive returns and to discontinue projects with lower or negative returns [Harrell and Harrison 1994; Harrison and Harrell 1993].

Managers' resource allocation may be affected by payoff-related factors such as investment payoff patterns (e.g., constant, slowly increasing, rapidly increasing, or lump-sum at the project's end) and types of investments (e.g.,

Table 1
Selected Studies on Resource Allocation Judgment and Decisions: Project-related factors

Author(s)	Year	Focus	Factors Studied	Major Findings
Rubin & Brockner	1975	Escalation in a puzzle-solving context	Speed of the declining payoff value	Students escalated more when potential payoff was declining slowly than when it was declining quickly.
Northcraft & Wolf	1984	Projects' investment and payoff patterns	16 possible combinations of investment and payoff patterns	Escalation is possible only when sunk cost is present. Among all of the 16 combinations, only some combinations give rise to sunk cost.
Ho, Keller, & Keltyka	2002	Outcome and probabilistic ambiguity	Payoffs and likelihoods of cash flows	Managers tended to choose the least ambiguous option when they perceive a large difference between options.
Friedman & Neumann	1980	To investigate whether opportunity costs will be asked for and used in decision-making	Opportunity costs	Subjects would request and use opportunity cost information in decision making, and they used the information as often as they used outlay costs, if the information was provided at equal (zero) cost. But they did not try to impute amounts of potential opportunity costs when no information was given regarding their magnitude.
Northcraft & Neale	1986	An information-processing explanation of the escalation behavior	Opportunity costs: implicit vs. explicit	When opportunity costs are ignored, setback decisions may be framed as choices between certain losses and the possibility of larger or no loss. Therefore, making opportunity costs explicit can alter the framing of such decisions and reduce escalation.
Devine & O'Clock	1995	To investigate whether prospect theory provides an explanation for sunk cost behavior	Historical costs; General vs. specific opportunity cost	Sunk cost affects resource allocation decision consistent with prospect theory in a loss condition, but not in a gain condition. Subjects have difficulty incorporating opportunity cost regardless of whether it is for a general or a specific purpose.

Table 1 – (Continued)
Selected Studies on Resource Allocation Judgment and Decisions: Project-related factors

Author(s)	Year	Focus	Factors Studied	Major Findings
Hoskin	1983	The effect of risk propensity and the presentation method of opportunity cost on resource allocation	Risk attitude Implicit and explicit cost information	MBA and Ph. D. students considered cost and made accurate decisions more often when explicit opportunity cost information was provided than when implicit opportunity cost information was given. Risk attitudes had no effect on individuals' use of opportunity costs.
Heath	1995	Effect of how cost is measured on cost awareness	Cost measurement	Additional investment that was not of the same measure as the original investment, e.g., additional work vs. initial investment in money, was likely to be treated as incidental and less costly.
Zeelenberg & Dijk	1997	To investigate the effect of time and effort investments on risky decision-making	Cost measurement; Gain and loss situations	In agreement with prospect theory, subjects were more risk averse in gain situations than in loss situations. Furthermore, incurring behavioral sunk costs appears to increase risk aversive choices, i.e., a reverse sunk cost effect.
Brockner & Rubin	1985	The effect of modes of investment on escalation	Investment mode	Passive investment mode gives rise to more escalations than active investment mode.
Rubin et al.	1980	Effect of investment mode on entrapment/escalation	Investment mode: passive vs. active	In experiment II but not in experiment I, entrapment was greater under passive conditions than under active conditions.
Milgrom & Roberts	1990	An analytical model	Qualitative factors: complementarity	A theoretical model that allows the exploration of many of the complementarities in modern manufacturing firms.

all up-front, mostly up-front, somewhat up-front, or constant) in both initial and subsequent stages. Northcraft and Wolf [1984] used numerical examples to demonstrate how different investment and payoff patterns affect managers' resource allocation. Furthermore, in a dynamic environment, payoffs and likelihoods of cash flow often change during the course of an ongoing project. The magnitude and expected speed of a change in cash flow may also affect managers' resource allocation. This is because changes in payoff value may affect managers' subjectivity in evaluating the projects and, subsequently, their resource allocation among different projects [Rubin and Brockner 1975]. Despite these factors' importance in managers' resource allocations, only few studies have tested them empirically in the management domain, and these project factors have received very little attention by accounting researchers.

Another element that directly affects both payoffs and likelihoods assessments is ambiguity.[4] In a management accounting context, Ho, Keller and Keltyka [2002] examined how managers make investment choices when they face probabilistic ambiguity in decisions under risk. They found that when managers are faced with imprecise probabilities, their perceptions of the risks involved influence their choice of either an ambiguous option (e.g., with a chance of success that falls within a wide percentage range) or an unambiguous option (e.g., with a more precisely estimable chance of success). More specifically, managers tend to choose the least ambiguous option, especially when they perceive a big difference between the options.

In sum, previous studies suggest that several factors concerning payoffs and likelihood of cash flows may affect managers' resource allocation. However, due to the scarcity of research in this area, we have little evidence on how managers are affected by these factors when they make resource allocation decisions.

Opportunity Costs

Opportunity costs are the forgone benefits of alternative projects. Textbooks on management accounting and capital budgeting stress that managers should incorporate opportunity costs into resource allocation decisions, along with the payoffs and likelihoods of the project, in all stages of resource allocation. However, prior studies have shown that managers under certain circumstances fail to consider opportunity costs when evaluating projects [e.g., Chenhall and Morris 1991; Friedman and Neumann 1980]. One factor that has been examined extensively is how opportunity costs are presented (i.e., explicitly versus implicitly) to the decision maker [e.g., Devine and O'Clock 1995; Neumann and Friedman 1978; Northcraft and Neale 1986]. Implicit presentation of opportunity costs refers to a general statement of returns earned on similar projects or on short-term investments; explicit presentation contains a clear statement of specific opportunity costs related to the current project.

[4] Ambiguity is defined as "uncertainty about the processes by which the outcomes are determined" [Curley and Yates, 1985, p. 274].

There are mixed findings regarding the presentation effect of opportunity costs on resource allocation. For example, in their studies involving MBA students, Friedman and Neumann [1980] and Northcraft and Neale [1986] found that the salience of opportunity costs affected individuals' initial resource allocation. However, in their studies involving undergraduate student subjects, Devine and O'Clock [1995] found no difference between the two types of presentations with regards to making capital allocation decisions. These inconsistent findings may be attributed to differences in the subjects' levels of business experience and/or to different salience levels of opportunity costs. For example, subjects in Northcraft and Neale's study were asked to write down alternative uses for the funds needed to continue the project, while Devine and O'Clock did not ask their subjects to do so. Thus, the salience of the opportunity cost may have been higher in the former study than in the latter.

Prior studies have also examined possible interaction effects of opportunity costs with other factors, such as risk attitudes and levels of responsibility, on individuals' resource allocation. Hoskin [1983] examined how risk attitudes affected managers' decisions when opportunity costs were presented either implicitly or explicitly. Graduate business students were asked to place newspaper orders based on either a traditional income statement or a modified statement with explicit opportunity cost information for the newspapers' past performance. Since only outlay costs (cost of purchase) appear to affect the profitability of a company under the traditional income statement, Hoskin predicted that decision makers might view outlay costs as more important than opportunity costs (i.e., forgone profit if the quantity ordered is less than the demand for newspapers). However, the modified income statement highlights the opportunity costs, perhaps causing subjects to view outlay and opportunity costs as equally important. Hoskin found that subjects considered opportunity costs and made accurate decisions more often when modified, in contrast with traditional, statements were provided. However, he found no effect of risk attitudes on individuals' use of opportunity costs.

In practice, managers are not provided with explicit opportunity cost information, so Chenhall and Morris [1991] chose to examine the effect of *implicit* opportunity costs, along with levels of responsibility and other factors, on managers' resource allocation. They reported that managers under the high-responsibility condition (i.e., those who initiated the project) were more likely to ignore information about opportunity costs than were their counterparts under the low-responsibility condition (i.e., those who inherited the project). Perhaps managers under high-responsibility had incentives to window-dress the project and thus were less likely to recognize opportunity costs. In sum, the above findings suggest that a manager's sponsorship of (responsibility for) a project may affect whether he/she includes opportunity costs in making resource allocation decisions.

Cost Measurement

Managers' resource allocations can be affected by how costs are measured and interpreted. When a project is evaluated with monetary measures,

additional nonmonetary inputs (e.g., time and work) may be interpreted as incidental investments and perceived as less costly than monetary inputs, or vice versa. According to mental accounting theory [Thaler 1980, 1985], if additional investments have been measured differently from the original investment, they must be converted to the same measure before they can be properly accounted for mentally.

Heath [1995] empirically tested the effect of how cost is measured on individuals' cost awareness. Undergraduate students were told that the project could be completed by using monetary or nonmonetary (i.e., time) resources. Half of the subjects were told that they had previously invested some money in the project, and the other half were asked to assume that they had spent a certain number of hours on the project. Heath found that subjects considering allocating additional resources tended to invest more money (time) when the previous investment was measured in nonmonetary (monetary) terms. This finding was especially true when the original investment came close to exceeding the project's total payoff.

Sunk cost is considered a sure loss, and, according to prospect theory, individuals in loss conditions tend to be risk-seeking. Zeelenberg and Dijk [1997] examined the effects of nonmonetary sunk costs on individuals' judgments in gain and loss conditions. Half of the subjects were asked to assume that they had expended time and effort on a project, and the other half were not provided this information. They found that nonmonetary sunk costs caused individuals to be more risk-averse in both gain and loss conditions, contrary to what prospect theory predicts. This finding suggests that reminding decision makers of the time and effort they have put into a specific project could lead them to be more risk-averse and to avoid the sunk cost effect.

Investment Mode

For ongoing projects, there are generally two investment modes—passive and active. According to Brockner and Rubin [1985], the "passive investment mode" means that an investment continues unless investors actively move to stop it. Conversely, the "active investment mode" means that an investment will be terminated automatically unless investors take action to have it continued. In the passive mode, doing nothing means to continue, but in the active mode, doing nothing means to quit. Managers can be asked to formally review existing projects either at the end of the project or periodically during its progress. When a project is to be evaluated at its completion, it is assumed that pre-approved funding will automatically be released as scheduled throughout the project unless managers act to discontinue it. This pattern resembles the passive investment mode. Managers in the active mode must review the project periodically, and the project will be discontinued automatically unless they can justify its continuance by showing favorable future prospects.

Rubin et al. [1980] asked subjects in the active mode group every three minutes whether they wanted to continue the investment task. The task continued only if the answer was "yes." Conversely, subjects in the passive mode

remained in the game and could quit only when they explicitly indicated they wanted to do so. Some of their experiments showed that subjects in the passive investment mode persisted longer, on average, and spent more money in the game. However, other experiments in the same study did not produce similar results. The divergence of these findings may be attributed to differences in the subject pools or to the different manipulations of the investment modes (weak versus strong). In a similar vein, Statman and Caldwell [1987] suggested that mandatory periodic project reviews and shorter evaluation periods are useful in discovering failing projects and mitigating poor managerial decisions.

2.1.2 Qualitative Factors

Qualitative factors that cannot be easily or objectively translated into quantitative terms are also important in resource allocation [Chan and Lynn 1993; Cheung 1993; Farazmand and Neill 1996; Hellings 1985]. Qualitative factors could be crucial in helping managers make good choices in the initial stages of projects. One such factor that has received attention is complementarity [e.g., Miller and O'Leary 1997].

Two variables are complementary if increasing one will make the other more attractive in maximizing a firm's value. Based on this theory, a firm's value will be maximized only when its core business decisions, such as those related to product choice, resource allocation, and human resources, are complementary to each other. That is, to maximize the firm's value, employees in different departments need to work together to identify complementary factors, and complementary departments also need to reach agreements on when and what changes are needed.

Complementarity comes from the theories of supermodular optimization and games developed in a series of studies by Milgrom and Roberts [Milgrom and Roberts 1990, 1995; Milgrom, Qian and Roberts 1991]. Milgrom and Roberts [1990] demonstrated that complementarity existed among firm technology, capital investment, and operating systems. For example, they demonstrated that a change in technology which improved communication and computation while lowering costs of flexible machinery favored a set of systematic changes in a firm's other core business choices, including capital investments that reduced variable production costs and costs of product design.

Milgrom and Roberts [1995] reported that General Motors spent about $80 billion on robotics and associated capital equipment during the 1980s, but the company failed to make complementary changes in its human resource policies and product development processes. As a result, early in the 1990s, GM had flexible production lines but produced only a single product model and incurred unprecedented losses on the corporate level. Recently, some empirical studies have examined complementarities in transfer pricing [Ghosh 2000] and organizational alliances [Sarkar et al. 2001] contexts. For example, Ghosh [2000] conducted an experiment on the transfer prices of intermediate products and found that complementary arrangements between sourcing (internal versus external) and compensation structure (based on division or firm

profit) significantly increased perception of fairness and reduced both conflicts between trading divisions and the time taken to reach an agreement. Sarkar et al. [2001] conducted an empirical study in the construction industry and found that, for alliances to create value, the partners of the alliances must have complementary resources and compatible cultures and operational norms.

2.1.3 Directions for Future Research

Previous non-accounting studies have examined how payoff patterns and the speed of payoff deterioration affect resource allocation [Northcraft and Wolf 1984; Rubin and Brockner 1975]. In the real world, managers encounter varying speeds of project deterioration which may affect their perceptions of risk and their willingness to undertake or continue a project. Future accounting research could examine the sensitivity of managers to the speed of deterioration. How do managers estimate the likelihood of future payoffs, and how do such judgments affect their evaluations of the economic merits of potential projects? Do evenly-distributed and unevenly-distributed payoff patterns affect managers' evaluations differently? How do different combinations of deterioration speeds and payoff patterns affect managers' risks propensity and their decisions on resources allocation?

Future studies could also examine the effects of risk and ambiguity of investment options on managers' resource allocations. In a dynamic environment, managers choose among investment options that are based primarily on possible outcomes and the likelihood of these outcomes. Prior studies have shown that managerial decisions are affected by the project's risk level and any ambiguity concerning payoffs and probabilities [Curley and Yates 1985; Ho, Keller and Keltyka 2002; Kahn and Sarin 1988]. However, the question of how risk and ambiguity of investment options affect resource allocations has received only limited attention [Schaubroeck and Davis 1994; Zeelenberg and Dijk 1997]. Systematic investigations of factors such as the project's risk level, salience of risk information, and ambiguity associated with payoffs and likelihoods would add to our knowledge of how these factors separately and jointly influence managers' decisions on resource allocation. Also, to shed more light on managers' resource allocation behaviors, future studies can examine whether (and how) risks associated with a particular project interact with opportunity cost information.

Few studies have examined how salience of costs affects managers' initial investment decisions. In particular, could different cost measurements motivate managers to ignore sunk costs? Our review suggests that decision makers' future investment choices and their perceptions of project risks are affected by whether sunk costs are presented in the same measurement as incremental costs (in both monetary and nonmonetary terms). Since prior studies used mainly undergraduate students as subjects, it remains unknown whether these findings will hold when actual managers are asked to consider that they have invested significant personal time in a project. Managers may attribute more worth to the personal time invested, and therefore they may not

treat monetary and nonmonetary resources differently. Future studies in cost measurement are needed to enhance our understanding of its effects on managerial resource allocation.

Further, in practice, both active and passive investment modes are common. Would a different investment mode yield "better" resource allocation decisions for ongoing projects? More empirical studies are needed to determine whether mandatory periodic project reviews or shorter evaluation periods could help discover failing projects and mitigate poor managerial decisions. Answers to the above questions could lead to approaches that eliminate biases and would help stem escalation in resource allocation.

In addition, a project may be financed internally (e.g., from earnings) or externally (e.g., debt or equity). Managers' evaluations and selections of projects can be influenced by the sources of funds and the risks involved in each specific project. For example, managers may decide to use loans with stipulated interests (not constrained) to fund less risky projects, and they may use funds raised from a capital market or earnings with no mandatory dividends to finance more risky projects. Thus, managers may view internal funds differently from external funds, thus the effect of resource origin on managers' resource allocation remains an important issue.

Traditional discounted cash flow analyses, in general, overlook the qualitative factors of an investment [e.g., Cheung 1993]. However, qualitative factors often may outweigh quantitative considerations. We have little knowledge of whether, how, and the extent to which qualitative factors influence managers' resource allocation. Prior studies have focused on one qualitative factor, complementarity. Hence, qualitative factors, such as investment flexibility and adaptability, provide great potential for future research. For example, future studies could explore the effects of (1) the ability to abandon a project in midstream and (2) growth opportunities of a project on managers' project assessments. In addition, it is also essential to investigate how trade-offs between quantitative and qualitative factors affect the success of a project.

2.2 Decision Maker-Related Factors

Prior research has also examined the characteristics of decision makers and how such traits affect resource allocation judgment. We have reviewed both accounting and non-accounting studies and then identified the following four decision maker-related factors: knowledge, academic training, domain-specific experience, and psychological factors (e.g., cognitive characteristics and risk propensity). Table 2 provides a summary of these studies.

2.2.1 Knowledge and Academic Training

Tan and Yates [1995] and Vera-Muñoz [1998] are two examples of studies that investigate the role of knowledge in resource allocation decisions. Tan and Yates [1995] have suggested that academic instruction has three major effects: it makes individuals aware of decision rules; it reinforces decision

Table 2
Selected Studies on Resource Allocation Judgment and Decisions: Decision Maker-Related Factors

Author(s)	Year	Focus	Factors Studied	Major Findings
Tan & Yeates	1995	The influence of instructions on sunk costs effects	Instruction: Explicit estimates of future returns	When instructed with pertinent economic rules or presented with explicit estimates of future returns of an option, subjects were less affected by sunk costs in their decision-making.
Vera-Muñoz	1998	Effect of general accounting knowledge on the use of opportunity cost	GAAP accounting knowledge, measured by number of accounting courses taken	Accounting graduate students, with a high level of general accounting knowledge, were more likely to miss opportunity cost than MBA students with a low level of accounting knowledge.
Chang & Ho	2002	Contextual factors and experience effect and managers' resource allocation decisions	Academic training/experience Project completion Market information	Experienced managers made resource allocation in response to varying project completion and market information, while student subjects were insensitive to the relevant indicators.
Garland Sandefur & Rogers	1990	Effects of negative feedback and experience on investments in an oil exploration context	Experience: geologist vs. student Number of unproductive wells drilled	When encountering negative feedback (dry wells), geologists tended to discontinue investment; however, students escalated their investment.

Table 2 – (Continued)
Selected Studies on Resource Allocation Judgment and Decisions: Decision Maker-Related Factors

Author(s)	Year	Focus	Factors Studied	Major Findings
Chenhall & Morris	1991	How cognitive style and responsibility affect managers' use of sunk & opportunity costs	Cognitive style Responsibility	Sensation-oriented middle- to senior-level managers wrongfully included sunk cost in decision making when the cost was specific. Intuition-oriented managers, on the other hand, wrongfully excluded opportunity cost in decision-making when it was for a general purpose. Regardless of their cognitive styles, managers ignored both sunk and opportunity costs when they felt individually responsible for initiating the project.
Ho & Vera Muñoz	2001	Effects of past performance and attribution on managers' capital budget recommendations	Loss aversion	Managers' recommendations were biased by their loss aversion. In particular, managers of high-performing divisions were more likely than managers of low-performing divisions to propose investments that maximize their division's short-term profits at the expense of the firm's long-term value.

rules by providing examples; and it increases the likelihood that proper decision rules will be utilized. They examined how academic instruction affects individuals' use of sunk costs in both business and personal contexts. Their study shows that undergraduates who have been taught the concept of sunk cost in a business context are less likely to commit sunk cost errors in a business context than in a personal context. This is because academic instruction has a stronger influence on decision behavior when there is a close correlation between a given decision problem and the context of the original instruction.

Vera-Muñoz [1998], on the other hand, has shown that accounting knowledge interferes with graduate students' ability to consider opportunity costs in business contexts. Vera-Muñoz predicted that general accounting knowledge would prevent subjects from incorporating opportunity costs into their calculations. The basis of her prediction was that GAAP accounting emphasizes historical costs and de-emphasizes opportunity costs. She measured accounting knowledge by the number of accounting courses completed by each individual. The results show that graduate accounting students (high accounting knowledge) were more likely to omit opportunity costs from their resource allocation decisions than were non-accounting MBA students (low accounting knowledge). In a structurally equivalent personal decision context, there was no significant difference between the performance of students with high accounting knowledge and that of students with low accounting knowledge. Taken together, these findings suggest that general accounting knowledge hinders performance in resource allocation decisions that require use of opportunity costs.

2.2.2 Domain-Specific Experience

Prior studies in management accounting suggest that general business experience may not help professional judgments and decisions [e.g., Harrison and Harrell 1993; Mowen and Mowen 1986]. Harrison and Harrell [1993] have shown that supervisory experience and years of business experience do not account for the differences in their subjects' responses on project evaluations. They attribute the lack of effect to the fact that their experienced subjects do not make such decisions routinely. This argument highlights the importance of matching the experimental task to the decision makers' domain-specific knowledge/experience [e.g., Libby, 1995].

Since the majority of extant escalation studies are based on experiments with student subjects, Chang and Ho [2002] examined the adequacy of using undergraduate students as surrogates for experienced decision makers in resource allocation contexts. Participants in the study were either managers with extensive work and project planning/evaluation experience or undergraduate students without business experience. Both groups possessed a basic knowledge of sunk costs and opportunity costs; all had taken at least one cost accounting course and had performed similarly on a test of their knowledge. Chang and Ho found a strong domain-specific experience effect on fund allocation decisions.

Garland, Sandefur and Rogers [1990] also demonstrated the effect of domain-specific experience in an oil exploration scenario. Both groups of petroleum geologists and undergraduate students were given the same authorized budget to drill up to five wells with the hope of finding productive wells to cover the cost. Both groups were told the actual costs incurred and were asked to indicate their willingness to drill a new well, given that one to four dry wells had already been drilled. They were also asked to assess the likelihood that the new well would be productive. Their results show that as the number of dry wells increased from one to four, the geologists significantly decreased their judgments as to the likelihood that the new wells would produce and were less inclined to authorize drilling another well if dry well(s) (that is, negative feedback) had been encountered. Conversely, the students' willingness to drill a new well and their projections about whether the well would produce were not sensitive to the number of dry wells.

2.2.3 Psychological Factors

Previous studies have suggested that psychological factors can affect individuals' resource allocation decisions [Arkes and Blumer 1985; Chenhall and Morris 1991]. In our framework, such factors include the decision maker's cognitive characteristics and risk propensity.

2.2.3.1 Cognitive Characteristics

Prior accounting studies have shown that cognitive characteristics affect individuals' decision making [see Ho and Rodgers 1993 for a review]. Such characteristics include cognitive styles and cognitive abilities. According to Kogan [1973], cognitive styles are defined as *distinctive* ways of acquiring, storing, retrieving, and transforming information; they are consistent and rarely change. However, cognitive abilities relate to knowledge encoding and retrieval, and they are concerned with skill level. Managers' resource allocations may be influenced by cognitive style and cognitive ability, since the former affects how they perceive opportunity and sunk costs, and the latter influences how they code, store, and retrieve knowledge.

Chenhall and Morris [1991] explored how cognitive style affects managers' use of sunk costs and opportunity costs. In a laboratory setting, they employed the Myers-Briggs personality type indicator to classify the styles of middle managers as either sensation- or intuitive-oriented. Sensation-oriented individuals prefer detailed, structured problems and routine, precise work. However, they show a general lack of aptitude for forming abstract relationships from the data. Conversely, intuitive persons perceive problems as a whole and rarely focus on individual elements in isolation; they dislike routine and precise work and prefer to solve new, unstructured problems. Chenhall and Morris found that managers with a sensation-oriented style include both sunk and opportunity costs for a specific purpose but exclude general costs, while managers with intuitive-oriented style exclude specific costs but include

general costs. Although the results support their prediction, because of a design flaw in their study, Chenhall and Morris could not rule out the possibility that sensation (intuitive)-oriented managers, when making decisions, were likely to include (exclude) sunk costs and exclude (include) opportunity costs.

2.2.3.2 Risk Propensity

Prior studies show that decision makers' risk propensity may affect their risk assessments on project evaluations [Baillie 1980; Glazer and Shmueli 1995; Goddard 1990]. Prospect theory suggests that managers use a reference point (target) to choose among alternatives [Kahneman and Tversky 1979, 1984]. In general, outcomes below the target point are evaluated as losses, and outcomes above it are evaluated as gains. Typically, losses appear psychologically bigger, thus, managers find them more aversive and painful than equivalent gains. This asymmetry of value relative to the reference point is known as "loss aversion" [Kahneman and Varey 1991]. A loss-averse manager would favor the *status quo* over alternatives of quantitatively equal expectations, because the disadvantages of these alternatives are evaluated as losses and therefore weighted more than their advantages [e.g., Heath, Larrick and Wu 1999; McCusker and Carnevale 1995]. That is, the framing of a project in a gain or a loss condition can affect a manager's resource allocation.

Some recent management accounting studies have investigated framing effects in resource allocation decisions [Rutledge and Harrell 1993, 1994; Sharp and Salter 1997]. These studies have found that framing significantly affects managers' and MBA students' commitment to prior projects and resource allocation decisions. These results imply that the framing effect can cause escalation behavior which may undermine organizational efficiency and effectiveness. In a capital budgeting study, Ho and Vera-Muñoz [2001] conducted an experiment to examine the effects of managers' loss aversion on tendencies to make goal-incongruent capital budget recommendations. They found that managers' recommendations are biased by their loss aversion. In particular, managers of high-performing divisions are more likely than managers of low-performing divisions to propose investments that maximize their divisions' short-term profits at the expense of the firm's long-term value.

2.2.4 Directions for Future Research

The above discussion points out that academic instruction and training sometimes improve [Larrick, Nisbett and Morgan 1993; Tan and Yates 1995] and sometimes impair [Vera-Muñoz 1998] the quality of resource allocation decisions. Furthermore, only domain-specific experience helps individuals make effective resource allocation decisions [Chang and Ho 2002; Garland, Sandefur and Rogers 1990]. Future studies could identify the conditions under which knowledge and experience would either enhance or hurt the quality of managers' decisions. Also, future accounting research could examine how individuals acquire knowledge of relevant cost concepts and decision rules from academic instruction. Also, how does pre-instruction experience affect

knowledge acquisition, knowledge retention, and resource allocation decisions?

Bonner [1994] proposed that task complexity could interact with the motivations and the characteristics of individual decision makers to affect their performance. Often, managers make resource allocation judgments and decisions in highly complex contexts. Future studies can examine how knowledge and experience affect managers' resource allocation decisions when they face highly complex situations. Also, could decision-aids (and what form of decision-aids) help managers make more effective resource allocation decisions in highly complex tasks?

There are relatively few studies examining the effects of decision makers' cognitive styles, cognitive abilities, and risk propensities on their resource allocations. Clearly, more studies in this area could provide additional insight into the effects of cognitive style on managers' resource allocation behaviors. Additional studies are needed to examine how cognitive ability affects information coding, retrieval and organization, and thus their impacts on managers' allocation judgments and decisions. Furthermore, how do risk propensity and ambiguity tolerance affect managers' investment decisions, individually and jointly with other factors (e.g., cognitive styles and domain-specific experience)?

2.3 Environment-Related Factors

The environment in which managers operate may also influence their resource allocation. For example, their judgments may be affected by organizational factors, such as performance evaluation systems, information asymmetry, job mobility and job security. In addition, since managers are socially connected with people outside the organization (e.g., potential employers, competing parties, family members and friends), their resource allocation may be affected by social factors such as reputation and justification needs. Studies that address environmental-related factors are summarized in Table 3.

2.3.1 Performance Evaluation Systems

Division managers have incentives to maximize divisional profit even though this may conflict with the firm's interest [Amershi and Cheng 1990; Demski 1994; Kanodia, Bushman and Dickhaut 1989]. To mitigate such conflicts of interest, upper-level managers need to design performance evaluation and compensation schemes that link division managers' incentives to the company's overall achievements, not just to the division's performance. For example, balanced scorecards and economic value-added measures are used to gauge managers' performance and to motivate them to work in the firm's best interest [e.g., Murphy 2000].

In general, managers' performance evaluation could be outcome or process-based. Outcome-based contracts, the most widely used system in business, can mitigate goal conflicts by providing managers with an incentive to maximize their bonus and the firm's value [Eisenhardt 1989]. Procedural justice

Table 3
Selected Studies on Resource Allocation Judgment and Decisions: Environment-Related Factors

Author(s)	Year	Focus	Factors Studied	Major Findings
Simonson & Straw	1992	Performance evaluation systems	Outcome- vs. process-based performance evaluation	Fewer resources were allocated to a failing project when subjects were held accountable for the decision process rather than for the outcome.
Harrison & Harrell	1993	Effect of information asymmetry and reputation on escalation	Information asymmetry Reputation	Managers chose to escalate when possessed private information about investment outcomes and when quitting the current project could damage their future employment opportunities.
Mannix & Loewenstein	1993	Effect of job mobility and subjects' prior knowledge on disinvestment decisions	Prior knowledge of job mobility High vs. low job mobility rate	Either high job mobility rate or prior knowledge of job mobility can cause a higher percentage of cash withdrawal.
Mannix & Loewenstein	1994	Effect of job mobility and individual vs. group decision making on fund withdrawals	High vs. low job mobility rate Individual vs. group decisions	Subjects were provided with uncertain rates of return ranging from 3% to 12%. With a fixed amount of investment, subjects could choose to withdraw funds during each run and/or evenly distribute the ending amount among firm members. The results indicate high job mobility led to high rates of withdrawal and individual decision makers withdrew more funds than groups.
Fox & Straw	1979	Business investment escalation	Job security Resistance from superior	Managers who feel insecure about their jobs and receive strong resistance from the board escalate more than those who feel secure and supported.

Table 3 – (Continued)
Selected Studies on Resource Allocation Judgment and Decisions: Environment-Related Factors

Author(s)	Year	Focus	Factors Studied	Major Findings
Kanodia Bushman & Dickhaut	1989	Agency theory and escalation behavior	Reputation Information asymmetry	Switching projects may signal that managers are less talented because of lack of foresight, and this may dampen their future job opportunities.
Staw Staw & Fox Staw & Ross	1976 1977 1978	Allocation of R&D fund to two divisions Allocation of bank loans to several course of action	Presence or absence of responsibility Positive vs. negative feedback	Investment managers (role-played by undergraduate students) invested a larger amount of resources in a failing project when they had initiated the project than when they had inherited it. Subjects processed information differently after a failure as opposed to a success.
Whyte	1991	Effects of responsibility diffusion on business investment decision	Group process: decision made by oneself vs. group vs. someone else	Use of a group decision process gave rise to diffused responsibility. Relative to when managers were personally responsible, group decision process weakened their tendency to escalate.
Whyte	1993	Effect of group process on individual business investment decision	Group process: decision made by oneself vs. group	When sunk cost was not considered a factor, group process led to de-escalation in decision making. When group members were held personally responsible for the sunk cost, group process exacerbated rather than mitigated escalation.
Rutledge & Karim	1999	Effect of moral reasoning and the adverse selection conditions on shirking	Adverse selection conditions Levels of moral reasoning	Managers are likely to continue a project that is expected to be unprofitable only when adverse selection conditions are present and moral reasoning level is low.

Table 3 – (Continued)
Selected Studies on Resource Allocation Judgment and Decisions: Environment-Related Factors

Author(s)	Year	Focus	Factors Studied	Major Findings
Chow et al.	1997	Effect of national culture on individuals' choices between continuance and abandonment of unprofitable projects	Culture effect Initial responsibility (self vs. other) Economic framed information (positive vs. negative).	The results show only weak effects due to responsibility and framing but a significant difference between the U.S. and Chinese nationals, with the latter preferring project continuance.
Harrison et al.	1999	Effect of national culture and private information on decision makers' willingness to continue an unprofitable project	Culture effect Private information and potential for personal gain.	Both the U. S. and the Chinese participants tended to continue the unprofitable project when they had private information and potential for personal gain. However, the Chinese MBA students had less tendency to do so compared to their U.S. counterparts.

literature, however, argues that a good decision cannot guarantee a good outcome, because most real decisions are made under uncertainty. That is, a firm should focus attention on the decision process and not simply on its outcome. Accordingly, to motivate managers to work in the firm's best interest, central management should use process-based performance evaluation systems or a combination of process and outcome, rather than decision outcome alone, to evaluate managers' performance [Bies and Shapiro 1988; Folger and Konovsky, 1989; Greenberg 1990; Moorman 1991].

Simonson and Staw [1992] empirically examined how different performance evaluation systems affect individuals' resource allocation. Undergraduate students were asked to justify their decision process (i.e., the effectiveness of decision strategies) or outcome to the instructor and other students. Simonson and Staw found that individuals who were accountable for decision outcomes had stronger needs for justification and underwent an increase in decisional vigilance, which then provoked them to allocate significantly more resources to a failing project. Conversely, individuals who were held accountable only for the decision process evaluated the available alternatives more thoroughly and were less inclined to support failing projects.

2.3.2 Information Asymmetry

For decentralized firms, a challenge in the agency relationship arises whenever central managers cannot perfectly monitor division managers' actions and information. Prior studies have suggested that division managers who have an incentive to shirk and possess privately held information tend to make decisions that maximize their own interests at the firm's expense [Antle and Fellingham 1995; Baiman 1982, 1990; Eisenhardt 1989].

In environments characterized by information asymmetry, division managers possess two types of private information: their own management ability, and information about all potential and current investment projects. A manager's ability may be partially revealed over time through his/her performance and reputation. However, information about potential investment options and future prospects of current projects cannot be observed by those outside the division if the organization's incentive scheme is not truth inducing. Some studies have used agency models to capture information asymmetry in resource allocation [e.g., Antle and Fellingham 1995; Arya, Glover and Young 1996; Balakrishnan 1991], but only a few have empirically tested the effect [Harrell and Harrison 1994; Harrison and Harrell 1993].

In Harrison and Harrell's [1993] study, MBA students were first informed that they had initiated four ongoing projects: two with favorable and two with unfavorable expected future returns. In the experimental group, subjects were told that (1) none of the information about the projects was available to their superiors and (2) a decision to discontinue a project would have a significantly negative effect on their potential outside job offer. Subjects in the control group were told the opposite. Their results show that when managers had private information about the prospects of investment alternatives and a strong incentive to conceal the truth, they continued the failing projects.

This finding matches the prediction of agency theory that managers who possess private information and have an incentive to misrepresent (e.g., maintaining one's reputation) will maximize their own interests. Harrell and Harrison [1994] also support this argument. They found that project managers with both an incentive to shirk and privately held information have a greater tendency to continue unprofitable projects than those who experience only one or neither of these conditions.

2.3.3 Job Mobility and Job Security

Other important factors affecting managers' resource allocation are job mobility and job security. High job mobility is considered a major cause of the short-term orientation of decision-makers [Rumelt 1987]. High job mobility not only may reduce managers' devotion to their firm, but may also encourage the allocation of resources to projects likely to yield high, short-term returns during their tenure [Mannix and Loewenstein 1993]. Thus, if a manager does not intend to stay with the organization long and if a project's future returns will not affect his/her reputation or compensation, the manager may act in his/her own best interest at the expense of the firm's value.

Mannix and Loewenstein [1993] simulated labor mobility in a multi-firm environment to explore the effects of job mobility/time perspective (short or long) on individuals' decisions. Subjects were told the firm's required rate of return and were subsequently asked to indicate the money they would withdraw from the firm during six rounds (each round representing a fiscal quarter). The results show that the managers with higher job mobility focused on shorter time horizons in decision-making and withdrew almost twice as much as those with lower job mobility. Perhaps, as the level of mobility increases, it becomes less likely that managers could benefit (e.g., through reputation and bonuses) from the long-term performance of their company.

Mannix and Loewenstein [1994] used MBA students and the same context as their 1993 study to examine how job mobility and group processes affect managers' perceptions of time. Consistent with their prior findings, they found that high job mobility leads to higher withdrawal rates. In addition, they found that groups made decisions consistent with a longer time horizon than did individuals. One possible explanation is that group members might judge that chances are very low that all of them would leave the company at the same time. For this reason, they may perceive lower job mobility than their counterparts in the individual condition.

In a similar vein, Fox and Staw [1979] conducted studies to examine how job security and resistance from superiors affect individuals' resource allocation. Undergraduate business students were asked to make a fund allocation decision. They were to assume that they felt either secure or insecure about their jobs and that there was either a strong or weak/no resistance to their decisions from the board of directors. Fox and Staw found that individuals' commitments to a previously chosen course of action increased as job insecurity and policy resistance increased. That is, subjects in the "insecure/strong resistance" condition were most likely to continue a failing project. Subjects

in the "secure/no resistance" condition were least likely to do so. Perhaps subjects in the "insecure/strong resistance" felt a stronger need to justify and defend their prior decisions.

2.3.4 Reputation

Managers looking for jobs outside their organizations are concerned about their reputations in the labor market. Based on institutional evidence, Hirshleifer [1993] pointed out three ways for managers to build and maintain their prestige and to increase their bargaining power: (1) by taking action to maximize short-term performance indicators at the expense of long-term performance (e.g., cashing out the project prematurely); (2) by manipulating the timing for resolving uncertainty by advancing the arrival of good news and delaying the bad; and (3) by mimicking the actions of successful managers and avoiding those of underachieving managers.

In resource allocation, a manager may select a project by considering its potential impact on his/her reputation. Further, once a manager commits to a project, any later change, especially after setbacks, may suggest that the manager lacks foresight or talent [Kanodia, Bushman and Dickhaut 1989]. In other words, abandoning a project after its initiation may damage the manager's reputation. To preserve reputation and secure future job opportunities, managers are inclined to escalate, rather than terminate, a project. Harrison and Harrell [1993] found that subjects were more likely to continue a project when a decision to abort it would damage their reputation and/or cause the withdrawal of a desirable external job offer than when the discontinuation decision would not affect their standing.

2.3.5 Need for Self-Justification

Managers often need to justify their resource allocation decisions to an evaluative audience. Most prior studies have examined this self-justification need by manipulating responsibility (high versus low) and have explored its relation to other factors such as experience, training, and information processing strategies. Justification exists at both individual and group-decision levels.

Various studies have explored individuals' self-justification needs [e.g., Staw and Fox 1977; Staw and Ross 1980]. A common finding is that subjects in high responsibility conditions (i.e., those who initiated the project) feel more responsible for unsatisfactory outcomes and, therefore, allocate significantly more resources than are allocated by those in low/no responsibility conditions (i.e., those who inherited the project). In a multiple-period setting, Staw and Fox [1977] reported that receiving negative feedback during the first one or two periods of the experiment strengthened, rather than weakened, the subjects' escalation behaviors. However, when more negative feedback was received afterwards, subjects rapidly abandoned the project, perhaps feeling they could no longer defend their reputations in a continuously deteriorating situation.

Prior studies have shown that academic training and business experience can affect individuals' needs for self-justification. For example, Staw and Ross [1980] examined the self-justification effect by having undergraduate psychology and business students, as well as MBA students, rate two administrators whose performance was below a given benchmark. While one administrator was described as persisting in his original policy, the other was portrayed as constantly changing his policy to find one that would work. Their main finding was that both undergraduate psychology and business students rated the two administrators equally favorably, although MBA students favored and agreed with the administrator who persisted in his original policy. Staw and Ross concluded that subjects with more education have higher self-justification needs and therefore are more vulnerable to the escalation error.

Major resource allocation decisions are often made by groups of managers rather than by an individual [Bazerman, Giuliano and Appelman 1984]. Collaboration by group members may help identify non-optimal commitments, since group members may feel that responsibilities have been diffused and shared. In other words, individuals may have less need to justify or defend the group decision. Conversely, individual group members may increase their commitments to a failing project because their belief is reinforced by other group members or group decisions, thus they may fall victim to groupthink[5] [Carnes et al. 1996; Janis 1982; Marxen 1990]. Therefore, findings at the individual level may not apply to group decision settings.

Evidence that group processes can mitigate escalation effects is found in Whyte [1991]. Whyte's subjects in the individual decision-making condition invested more frequently and committed more funds to failing projects than those in the group responsibility condition. However, in a follow-up study, Whyte [1993] reported that group decision processes increased individuals' tendencies to make resource allocation decisions that are more extreme than they would make without group input. More specifically, when there was no sunk cost, subjects tended to discontinue an unfavorable investment, and the group process fortified this tendency. Conversely, when subjects were personally responsible for the sunk cost, they were more likely to escalate resources than those who were not responsible for it, and the group process again strengthened the subjects' escalation behavior.

Rutledge and Harrell [1993] have suggested that group resource allocation decisions are influenced by a group polarization effect. They examined the impacts of responsibility and framing on group decision making and the resulting implications for resource allocation. They found that when individuals were not responsible for the initial investment decision or when investment alternatives were positively framed, groups were less risk-seeking than individuals. However, when individuals were responsible for the initial investment decision or investment alternatives were negatively framed, groups were more risk-seeking than individuals. These findings are consistent with prospect theory and group polarization literature.

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[5] In this paper, we refer to "groupthink" as a tendency for group members to move toward the majority position in the group even when the position taken by the majority is wrong.

2.3.6 Ethics and Culture

When making resource allocation judgments and decisions, managers may also be influenced by other factors such as the ethical standards required by the company [Harrell and Harrison 1998; Rutledge and Karim 1999]. For example, Rutledge and Karim [1999] indicated that project evaluation decisions of managers with high levels of ethical/moral reasoning were not significantly influenced by the presence of adverse selection conditions. Few studies have been done on ethical standards in the managers' resource allocation context, thus additional research is needed to shed light on how such standards affect managers' resource allocation behaviors.

In addition, cross-cultural studies in management accounting suggest that national culture affects the use, as well as the design, of management control systems, and the values, risk propensity, and knowledge sharing of managers [e.g., Chow, Deng, and Ho 2000; Chow, Shields and Chan 1991]. In multinational companies, culture may affect managers' resource allocations [Chow et al. 1997; Harrison et al. 1999; Sharp and Salter 1997]. Chow et al. [1997] tested the effects of initial responsibility, framing, and national culture on individuals' choices between continuance and abandonment of unprofitable projects. Their results showed only weak effects due to responsibility and framing, but there was a significant difference between the U.S. and Chinese nationals, with the latter preferring project continuance. Chow et al. attributed this finding to the higher collectivism of Chinese culture. They indicated that Chinese nationals also have a greater aversion to admitting failure (via abandonment), as this would damage their 'face' and social standing among peers. However, Harrison et al. [1999] reported opposite findings on national culture. They examined the effects of private information, potential for personal gain, and national culture on project continuance decisions. Their findings indicated that U.S. subjects continued unprofitable projects more often than their Chinese counterparts. However, when they had private information and the potential for personal gain, both national groups tended to continue the unprofitable project.

2.3.8 Directions for Future Research

Most of the prior studies on performance evaluation systems have used archival data to address how evaluation measures affect an organization's performance [e.g., for a review, see Ittner and Larcker 2001]. Only limited research has used an experimental approach to address issues concerning how performance evaluation systems affect managers' resource allocation. Furthermore, the archival data approach usually ignores the effects of behavioral considerations and cost consequences on managers' decision-making [Smith and Wallace 1995]. Therefore, more laboratory and field studies should examine how performance evaluation systems could effectively motivate managers to maximize the firm's value and not merely their own interests. Such research approaches could also provide more insight into what the behavioral considerations and cost consequences are that concern managers facing different evaluation systems.

Another important environment-related factor, job mobility/security, has received little attention from management accounting researchers. Job mobility/security may influence managers to focus on either the short- or the long-term, which may then affect their resource allocation. Experimental or field studies conducted in rich and realistic business environments would be helpful in examining the effects of job mobility/security on managers' resource allocation behaviors. Furthermore, it would be beneficial to identify factors that may influence managers' perceptions of job mobility/security, such as organizational cultures and information-processing modes (individuals versus groups).

Many resource allocation decisions involve more than one decision maker, and diffusion of responsibility has considerable theoretical and practical importance [Brockner and Rubin 1985]. Given the limited and mixed results of research on how group decision processes affect resource allocation [Bazerman, Giuliano and Appelman 1984; Rutledge and Harrell 1993; Whyte 1991, 1993], it is important to examine how environment-related factors, such as performance evaluation models, information asymmetry, and job mobility/security, interact with group decision making in resource allocation. Also, future studies can explore how group decision-making processes interact with individual decision makers' cognitive characteristics and risk propensity.

Prior audit research has examined whether using technology such as group decision support systems (GDSSs) could help auditors make better judgments and decisions [e.g., Bamber, Hill and Watson 1998; Ho 1999]. Today, GDSSs are available to many companies, and similar systems are available through distributed network systems such as corporate intranets. Bamber, Hill and Watson [1998] report that using GDSS may increase the effectiveness and efficiency of group work and communications. However, such benefits may not occur in every environment. It will be fruitful for future studies to compare resource allocation judgments and decisions made at the individual level with those made under the influence of GDSSs and face-to-face discussions. The findings would have an immediate application to upper-level managers in multinational firms by demonstrating if and when a GDSS can assist team managers in different departments and locations in making allocation decisions.

Furthermore, managers may use affect-based decision rules in allocating resources. For example, between two investment proposals, the one submitted by an in-group member, such as a manager's protégé, may be considered more favorably (perhaps the manager would rather maintain the relationship than achieve higher economic returns). Future studies can examine the effect of a manager's relationship with the person who submits the investment proposal (i.e., ingroup vs. outgroup) on resource allocation decisions [see Asare and McDaniel 1996]. Future research could also investigate the effects of social factors on managers' resource allocations. For example, managers, when making decisions, normally consider how others would act in the same situation. It would be interesting to examine empirically how managers mimic others' (e.g., a predecessor's, a competitor's etc.) decisions on resource allocation when they face uncertainties.

3.0 FEEDBACK

After carrying out a project, a manager usually receives some feedback (e.g., positive/negative feedback) about the costs (e.g., money, time and effort) incurred, the overall market and potential competitors' reactions, degree of project completion, and realized and expected returns. Often, managers must reassess the prospects of the project and then decide whether to allocate additional resources to the project or discontinue it. Studies reviewed in this sub-section are summarized in Table 4.

3.1 Positive and Negative Feedback

Feedback can be classified as positive or negative, depending on whether the information provided makes managers believe that the project's outcome will be above or below the company's benchmark/requirement. A manager may put more resources into a project in the presence of positive feedback but may reduce funds or quit a project after receiving negative feedback. Prior research has documented, however, that individuals commit more resources when they have received negative feedback [e.g., Staw 1976]. However, Ghosh [1997] has suggested that this escalation can be alleviated by feedback. That is, the feedback should also include previous expenditures, incremental costs and benefits, as well as the negative outcome. Managers can also avoid the undue influence of negative feedback by preparing progress reports for ongoing projects. Also, Garland, Sandefur and Rogers [1990] have shown that experience modifies the effect of negative feedback on individuals' commitment. Specifically, decision makers who possess domain-specific experience are discouraged from allocating more resources when they receive negative feedback.

The studies suggest that negative feedback can motivate individuals to commit to failing projects in some situations but weaken their commitment in others. We attribute the discrepancy of these findings to differences in the assigned tasks and also to differences in the levels of experience-related knowledge possessed by the decision maker. Future research could extend Ghosh's [1997] study by examining whether different management control procedures affect managers' resource allocation judgments and decisions.

3.2 Completion Percentage

The degree of project completion is one important aspect of feedback information. Previous studies have suggested that the degree of project completion affects individuals' commitment to a course of action [Conlon and Garland 1993; Garland 1990; Garland and Newport 1991]. The closer a project is to being completed, the more likely it is that managers will continue the project. Image theory suggests that once a project has been initiated, completion, rather than success, may become the manager's highest priority [Mitchell and Beach 1990; Silver and Mitchell 1990].

Table 4
Selected Studies on Resource Allocation Judgment and Decisions: Feedback

Author(s)	Year	Focus	Factors Studied	Major Findings
Ghosh	1997	To test whether three management control procedures can reduce escalation of commitment.	Unambiguous feedback; Preparation of a progress report; Information about future benefits of additional expenditures	Escalation of commitment is greater when negative feedback is ambiguous than when it is unambiguous. Both preparing a progress report and providing information on future benefits of the incremental investment reduce escalation commitment.
Garland, Sandefur & Rogers	1990	Effects of negative feedback and experience on investments in an oil exploration context	Experience: geologist vs. student; Number of unproductive wells drilled	When encountering negative feedback (dry wells), geologists tended to discontinue investment; however, students escalated their investment.
Garland & Newport	1991	Topical organization of mental accounts underlies the sunk cost effects in decision-making	Absolute vs. relative magnitude of sunk cost	The relative, rather than the absolute, magnitude of sunk costs had a significant impact on the subjects' reported likelihood of committing additional funds to some action.
Conlon & Garland	1993	Effect of project completion and competitor's information on investment decisions	Sunk cost Project completion Competitor's information	Subjects were more willing to put additional resources into the project with sunk cost when it was close to completion. When information about both sunk cost and degree of completion was available to subjects, they were more influenced by the degree of completion than by sunk cost. They also escalated more when they believed there was no threatening competitor.

Garland and Newport [1991] found that students' willingness to continue investing is positively correlated to the degree of project completion. However, for fund allocation decisions, that effect may become confounded with the absolute amount of sunk costs, because a higher degree of completion also represents a larger amount of sunk costs. In light of Garland and Newport's [1991] work, Conlon and Garland [1993] separated the specific effects of project completion and the absolute amount of sunk costs. Besides confirming the project completion effect, Conlon and Garland showed that the absolute amount of sunk costs had no impact on the decisions. They explained the completion effect as "goal substitution": as time goes on, individuals subconsciously change their goals from profit maximization to task completion, especially in projects' late stages.

4.0 CONCLUSION

This paper has used a framework to review and analyze experimental research on resource allocation in the areas of accounting, management, and social science. This framework categorizes factors affecting managers' resource allocation judgments into three perspectives: project-related, decision maker-related and environment-related. The review facilitates comparisons and contrasts of these studies and also highlights potential areas for future research on each of the three categories of factors. Furthermore, we have discussed how different types of feedback affect managers' ongoing resource allocations.

The relationship between resource allocation judgments and decisions is an important part of the resource allocation process. However, most prior studies have examined individuals' resource allocation judgments and fund allocation decisions separately. More studies should explore the link between judgments and decisions and the critical factors that affect such a linkage. Our framework provides a systematic and holistic approach for future studies to examine multiple contingency relationships (i.e., the interaction effects among three categories of actors) in resource allocation.

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1. Chenhall, R., and D. Morris. 1991. The effect of cognitive style and sponsorship bias on the treatment of opportunity costs in resource allocation decisions. *Accounting, Organizations, and Society* 16: 27-46.

Two factors were studied to determine how they influence the way managers incorporate implicit opportunity costs in their decision making: intuitive- versus sensation-oriented cognitive style, and whether or not the managers sponsor the project. Results of the experiment confirm their predictions that, in the absence of sponsorship, managers with an intuitive- (sensation-) oriented cognitive style will be more (less) likely to consider in their decisions implicit opportunity costs with a general purpose, but they will probably ignore (include) those with a specific purpose. Also, managers are more likely to exclude opportunity costs when they have sponsored the project than if they have not.

2. Conlon, D. E. and H. Garland. 1993. The role of project completion information in resource allocation decisions. *Academy of Management Journal* 36: 402-413.

Conlon and Garland's study investigated the influence of degree of project completion on the subjects' escalation. In the first experiment, four levels of sunk cost, four levels of project completion and two levels of competitor information were fully crossed to form 32 experimental conditions. Upon receiving the information on sunk cost, completion stage, and competing products, subjects were asked to give their assessments of the probability they would authorize further expenditure. The results showed that sunk cost alone did not cause subjects to escalate; the key factor behind escalation was the degree of project completion. Also, subjects escalated their spending more when they were told that their competitor's product was inferior and when they perceived their competitor as less threatening. The second experiment, with two levels of sunk cost and completion stage, again confirmed the findings.

3. Harrison, P. D., and A. Harrell. 1993. Impact of adverse selection on managers' project evaluation decisions. *Academy of Management Journal* 36: 635-643.

Agency theory and analytical research suggest that managers with private information and incentive to shirk will not act in the firm's best interest. This study empirically tested this prediction in investment decision contexts. MBA students participated in the experiment. Each of them was asked to make an investment/disinvestment decision for four projects: with combinations of a positive or negative IRR in the remaining life of the project and with its overall return being either above or below the target IRR. Subjects were randomly

assigned either to the control or to experimental condition. In the control condition, they were informed that the prospective IRRs of the four projects were public information and the performance of the projects would have no impact on their managerial reputation. Subjects in the experimental condition were told the opposite. If managers maximize the firm's profit, they will continue those projects with positive future IRRs and disinvest from those with negative IRRs in the future, even if their overall IRRs exceed the target rate. As predicted, subjects in the experimental condition were less likely to quit a project with negative future IRRs than those in the control condition, regardless of whether their overall returns were above the target IRR.

4. Kanodia, C., R. Bushman, and J. Dickhaut. 1989. Escalation errors and the sunk cost effect: An explanation based on reputation and information asymmetries. *Journal of Accounting Research* 27: 59-77.

This study developed models to explain managers' escalation behavior. The theme of the models is that the wages of managers are expected to increase with their reputation for talent. The study proved that when information about a manager's human capital (i.e., talent) is private and can only be inferred by others from observation of his prior actions and their consequences, the manager will escalate resources for failing projects. If the manager switches to another project from a failing project, he reveals information that damages his reputation and decreases his opportunities in a labor market. The results suggest that escalation errors are less likely to occur in a public information world, and that in a private-information world, escalation behavior is caused by the manager's desire to build a reputation.

5. Mannix, E. A., and G. F. Loewenstein. 1993. Managerial time horizons and interfirm mobility: An experimental investigation. *Organizational Behavior and Human Decision Processes* 56: 266-284.

Using a simulation in a multifirm environment, this study explored the effects of job mobility on individuals' decisions. MBA students were asked to assume the role of a partner in a small hi-tech computer company. Job mobility was manipulated as either high or low. To explore the effect of prior knowledge, half the subjects were informed about the mobility rate before they made the decision and the other half were not. Subjects were asked to indicate the amount of money they would withdraw from the firm. The results showed that when the rate of job mobility was high, subjects withdrew almost twice as much as those faced with a low chance of mobility. In addition, those without prior knowledge of mobility withdrew more than three times as much as their counterparts did. Mannix and Loewenstein argue that no prior knowledge of mobility rate may have caused a feeling of higher uncertainty, which in turn led to larger withdrawals.

6. Simonson, I., and B. Staw. 1992. De-escalation strategies: A comparison of techniques for reducing commitment to losing courses of action. *Journal of Applied Psychology* 77: 419-426.

Simonson and Staw's study investigated and compared six de-escalation strategies. Strategies were designed either to reduce the subjects' need for self-justification or to stimulate more accurate decision-making. The experiment follows a 1×7 design with one base-line investment task and six de-escalation strategies: thorough decision-making, minimum goal setting, threat reduction, self-diagnosticity, accountability for decision process, and accountability for decision outcome. The three most effective strategies found were (1) making negative outcomes less threatening; (2) setting minimum target levels so that failure to achieve them will lead to policy change; (3) using a process-based, not an outcome-based, performance evaluation method.

7. Vera-Muñoz, S. C. 1998. The effects of accounting knowledge and context on the omission of opportunity costs in resource allocation decisions. *The Accounting Review* 73: 47-72.

This study examined how GAAP accounting knowledge of historical costs can affect subjects' treatment of forward-looking opportunity cost. Subjects with two levels of accounting knowledge reviewed two resource allocation cases: one in a business and one in a personal context. While both groups performed equally well in the personal context, subjects with a high level of general accounting knowledge were more likely to exclude the opportunity cost when making decisions in the business context.

8. Whyte, G. 1993. Escalating commitment in individual and group decision making: A prospect theory approach. *Organizational Behavior and Human Decision Processes* 54: 430-455.

This study examined how sunk cost and group decision process shape an individual's choice of whether to continue a failing project. Sunk costs were manipulated in three conditions: no sunk cost, sunk cost, and personal responsibility for sunk costs. The results reveal that participation in a group discussion strengthens the individual's resolve and thus encourages individuals to make more extreme decisions. Specifically, when there was no sunk cost, individuals tended to discontinue the unfavorable investment, and the group process further fortified this tendency. Conversely, when individuals were personally responsible for the project, they were more likely to escalate resource allocation and the group process again strengthened individuals' escalation behavior. In sum, group decision processes appear to exacerbate individuals' tendencies to make extreme resource allocation decisions.

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