

## EMERGING ROLE OF ACCOUNTING AND ACCOUNTANTS IN EXECUTIVE INFORMATION SYSTEM: EVIDENCES FROM LITERATURE

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*The role of information systems in decision making has become particularly prominent in recent times with the advent of affordable technology. Businesses routinely use such methods to increase efficiency. A particular field that merits attention in this field is executive information systems which assist top management in decision-making. Researchers in this paper have tried to highlight the relevance of including accounting information into this system. This paper outlines a framework where accounting plays a vital role in aiding complex decisions under both high and low levels of uncertainty. Accounting's undeniable role in product costing decisions and in measuring productivity serve as a basis for showing that inputs from this area are needed in order to reach goals when multiple conflicting objectives may be present. The need for accounting information at this level will continue to grow and better decisions will require further incorporation of such knowledge into the executive information systems.*

**Keywords:** *Accounting Information Systems, Business Strategy, Technological explosion, Role of Accounting in Decision-making*

### PROLEGOMENA

The potential for utilization of computers as part of information systems in the business environment was realized as early as the 1960s. Historically, many executive decisions relied heavily on information that was captured, processed, and reported by middle managers. One estimate suggests that middle management spends up to 80 percent of its time collecting, processing, analyzing, and passing on information (Fireworker and Zirkel 1990, 26). Today, the role of middle managers as information czars is diminishing. Technology makes it possible for companies to automate many data processing activities traditionally performed by middle managers in support of executive information needs. Such an automated system is called an executive

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information system (EIS)<sup>4</sup>.

Executives are managers with formal authority over the whole of an organization or an important functional unit of one" (Thierauf, 1991). They have responsibility and are accountable for the results of their actions, to either other executives (higher on the organizational scale) or to the owners of the organization (McLeod and Jones, 1986). A prominent characteristic of the executive's role is the making of decisions (Mintzberg, 1975). This refers to evaluating possible courses of action and selecting and initiating one of them. In order to take effective decisions, accountants need to have access to 'high quality' information. Such information needs to be relevant to the variables affecting the outcome of the decision, accurate, timely and up to date. Moreover it needs to be accessed easily and presented in a format that makes it easily understood.

Much of the focus of EISs has been on capturing and processing exogenous information (Frenkel 1990; Giordanella 1989), such as stock prices, or on improving communications among executives through electronic mail (Giordanella 1989). Many EISs access on-line databases that provide windows to Wall-Street and allow monitoring of external events that may affect the organization. Internal data on the results of operation, financial position, cash flow, and other operating events are equally relevant for many executive decisions. Although several companies reported using their EIS to help monitor operating data (Armstrong 1990a and 1990b; Bulkeley 1988; De Long 1988; Harvey 1989), literature is scarce how EISs impact the transaction processing system of financial accounting and the internal reporting function of managerial accounting.

This paper discusses the impact that EISs will have on accounting and on the roles that accountants, particularly managerial accountants, assume as contributors to these systems. The potential is unlimited for improved decision making by fully exploiting EISs for data analysis. The discussion assumes Ijiri's (1967, 3) broad definition of accounting as "a system for communicating the economic events of an entity". Given this definition, the paper explores the disparate roles that accounting and accountants can serve to provide data critical for executive decisions under different levels of uncertainty. As a frame work for this analysis, the authors use a model based on research by Thomson and Tuden (1959) and Burchell et al. (1980). Practical anecdotes are presented to depict the importance of accounting information to executive decisions and critical accounting roles in an EIS.

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4. Executive information systems are also called executive information and decision support systems (Martin 1989; Mc Namarna et al. 1990), and enterprise information system (Pinella 1991).

## MEANING OF EIS?

The term 'Executive Information Systems' was introduced in 1982 (Rockart and Treacy, 1982) to describe the kind of systems a few senior corporate officers were using on a regular basis to access information they needed. Unfortunately, there is no standard, universally accepted definition as to what the term EISs encompasses. Different researchers use a different working definition which usually refers to some characteristics of what the term 'Executive Information Systems' describes. In much of the literature the term Executive Support Systems (ESS) is used interchangeably with EISs to describe the same kind of system. Rockart and Delong (Rockart and Delong, 1988), make a distinction between the two terms. They define and use the term ESS to refer to systems with a broader set of capabilities than EISs. While the term EIS denotes providing information.

EISs are defined as computerized information systems designed to be operated directly by executive managers without the need of any intermediaries. Their aim is to provide fast and easy access to information from a variety of sources (both internal and external to the organization). They are easily customizable and can be tailored to the needs and preferences of the individual executive using it. They deliver information of both soft and hard nature. This information is presented in a format that can be easily accessed and most readily interpreted.

Executive information systems provide non-technical, real-time environments in which executives can access on an ad hoc basis whatever information is needed to either confirm or refute a perception about the business at a particular moment in time. John N. Kelly notes:

*An executive information system is a set of tools designed to help an organization carefully monitor its current status, its progress toward achieving its goals, and the relationship of its mental model of the world to the best available clues about what's really happening. (Fireworker and Ziekel 1990, 25)*

These tools are designed to overcome drawbacks of traditional approaches of gathering information for executive users. Typical drawbacks include poor response time, poor graphics flexibility, difficulty in mastering computer systems' command structure, and limited scope (Giordanella 1989)

Executives often have unique information needs that differ from lower-level decision

makers because of the unstructured nature of executives' decisions and their level of authority. Executives make strategic decisions having long-range implications for the company and also possess ultimate responsibility for day-to-day operational decisions of subordinates. Fulfilling these responsibilities requires information that is timely, easy to interpret, and broad in scope. Advances in technology are helping to meet these needs and EISs are rapidly becoming a necessity for many large companies in today's competitive global environment.

### **EISs AND THEIR SUCCESSES AND FAILURES**

The main focus of the EISs is to provide improved information to executives quickly and accurately. Although savings in the time taken to deliver information are increased significantly, the actual benefits are not always direct. Savings in time can be tied to an improved mental model, of the executive about the organization, and its relation to various other external variables, which in turn results in better decision making. The value of the system depends on how useful the executives using it, perceive it to be, and how much it is being used (DeLong and Rockart, 1992).

Executive Information Systems (EISs) have experienced successful marriage with several firms and failures with others. EIS advocates stress numerous benefits, such as improved communication among the management team, reduced time required for problem identification, more time available for problem solving, and improved accounting system with more comparable accounting reports among units. Foremost among the benefits is that, in planning and implementing an EIS, management is forced to link the firm's objectives to corporate strategy. Executives can then identify appropriate performance indicators representing critical success factors for the company (Bird 1991, 98). Over this entire process, executives' information needs must be ascertained and subsequently incorporated into the EIS to enhance managers' effectiveness in performing their jobs.

An EIS could generate tremendous benefits to the organization. A survey of Information System managers in the US on the grouping of EIS benefits conducted by Iyer and Aronson (1995) indicates that those benefits are very broad, from the availability of data to the improvement of executive performance. Based on that study, it can be seen that the tangible and intangible costs of not using an EIS are significant. In addition, an EIS could create positive effects on the entire image of the organization, such as retaining and attracting high quality staff as well as providing a better image to the customers,

suppliers, competitors and investors in the marketplace (Millet and Mawhinney 1992)

Another case study demonstrates that the traditional two-dimensional view of the accounting information system has been replaced by a sophisticated, real-time multi-dimensional environment. Accountants can now manipulate the various multi-dimensional cubes to produce top-quality information to management. In summary, the benefits of the EISs include the following:

- Significant reduction in time and updated the methods/structures associated with distributing, analyzing, forecasting and consolidating financial management reports periodically.
- Offer better tools to analyze data underlying the line items in the monthly financial management reports more effectively and efficiently.
- Lessen the risk associated with undocumented and complex processes and reliance on one person to maintain the systems that support financial management reporting.
- Streamline and simplify the maintenance of reporting templates and supporting systems.
- Provide the potential to realize productivity gains in areas currently using inefficient reporting tools and areas responsible for coordinating, staging, distributing and consolidating financial management information.
- Offer opportunities to implement improvements in other areas such as budgeting and project reporting.

The Hertz corporation experienced success with its EIS since implementation in 1985 (McCartney 1989). Using the EIS, Hertz executives are able to respond more quickly to the competition and make improved and more consistent decisions. The EIS has enabled Hertz executives to more effectively:

assess market shares in a contested area, gauge price levels in relation to costs, project the rental volume needed to offset a price decrease and measure cost changes against historical....[Executives can also] perform "what-if" scenarios to determine the long-term effect of pricing trends. (McCartney 1989, 46)

Hertz credits the EIS for reduced personal costs, more productive executive sessions, better planning and evaluation of new product and price offering proposals, and more informed decisions on whether to accept business at a special price.

Another example of a successful EIS is explained by Clare Hollingsworth, the managing director of Caledonian Airways (CA), a subsidiary of British Airways (Bird 1991). Since CA's EIS became operational in 1990, twelve top executives are using the system. Ms. Hollingsworth specified the airline's critical success factors as "bottom-line profit, departure punctuality, in flight duty-free sales, flight hours per aircraft, return on assets, and critical services" (Bird 1991, 98). With CA's EIS, she can monitor the airlines progress in each area to evaluate whether actual results are exceeding, about even with, or falling short of goals. Through this efficient process, Ms. Hollingsworth performs management by exception, concentrating her time and effort in areas warranty attention. With the EIS, she can obtain a broad overview of a problem and use the "drill down" approach to locate specific problems in individual units within the firm. Bird (1991, 98) summarizes the drill down process as follows:

*If bottom-line profit is too low, [she can determine] which area of the business is responsible—revenues, aircraft operating cost, or department overhead? If [the area of] operating cost is the culprit, she can, with a click of her pointing device, "drill down" another level to view the cost for each individual component—fuel, engineering, landing fees, passenger catering, or aircraft handling. Another click will reveal whether the cause was price, rate of exchange, or volume of flying.*

The EIS enables Ms. Hollingsworth and other executives to obtain whatever summary or detail data is needed to locate and determine the source of problems. Once the problems are identified, they are discussed among the managers. Whatever this function is preformed timely and efficiently, more attention can be given to resolving problems. Yet, "drill down" is only effective when the data contained in the system are current and reliable.

Significantly problems with the "drill down" approach for analyzing cost data were experienced with the EIS of the North American Aircraft (NAA) division of Rockwell International.<sup>5</sup> Although the EIS at NAA has been an overall success (Armstrong 1990a and 1990b), an attempt to integrate cost data into the system for executive analysis failed. This failure appears attributable to two problems:

- 1) Cost data at NAA are subject to an extensive review and approval cycle because of their critical importance. This extensive review process, along with the tasks of

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5. The remaining discussion in this section is based upon a telephone interview with David Armstrong, a senior analyst at NAA, conducted on May 22, 1992.

entering and updating the mainframe database, placed accounting/finance managers into a continuous loop of activities. This loop of activities required excessive time which made the data unavailable on a timely basis.

- 2) Executives resisted the use of the system for cost analysis because they thought that: (a) the application was too chamber-some and (b) lower-level managers should perform the "drill down" analysis for them. In summary, the executives wanted answers, instead of having to obtain the answers through their analysis.

NAA is currently in the process of replacing all "drill down" functions in its EIS with periodic slide shows to present cost data and analysis.

### **EISs AND THEIR GENERAL PROBLEMS**

A system that provides on-line, summarized and graphical information about a business is desired by many decision makers, but attempts to deliver this type of system have often proved difficult (Reck and Hall, 1986; Volonino and Robinson, 1990, Watson *et al.*, 1992). There is limited information available to assist practitioners regarding the question of how to minimize the risk of executive information system (EIS) failure (e.g. Watson *et al.*, 1991; Zmud, 1993). Research into the implementation of EIS in the 1980s showed that these systems were expensive to develop and required continual resources to maintain (Watson, 1992). They were designed mainly for larger organizations with mainframe information systems (IS) and most of the development time went into creating sophisticated graphical interfaces. Since then information technology (IT) has advanced and practitioners and executives are more informed about the nature and use of technology. Research is therefore required to see whether EIS are still high risk systems and if so in what circumstances. Earlier researchers provided a list of factors to take into consideration when implementing an EIS to ensure its success, yet systems still failed even though these factors were addressed. It is possible that other issues may have a bigger influence on the success of EIS than was first envisaged.

One survey of 50 firms with successful EISs indicates that 21 firms experienced a previous EIS failure (Watson and Glover 1989). Another survey of 71 executives reveals that 57 percent foresee great benefit from an EIS but anticipate significant problems (De Long 1988). Although cost are declining dramatically, EISs are still high cost ventures (Ryan 1989; "Executive Information System: New system for..." 1987) where problems can result in significant losses (Schwartz 1990). Certain critical success factors must be

given careful consideration if an EIS is to succeed (Fireworker and Zirkel 1990; Giordanella 1989; Armstrong 1990b; Watson and Glover 1989). Implementing an EIS is a major undertaking that requires diligent planning and coordination of efforts among numerous participants (Armstrong 1990b; Eskow 1990). In addition, many executives are reluctant to use computer systems ("What Users Want Today" 1990; Martin 1989). Moad (1988, 43) describes this reluctance: "You can't get them [reluctant executives] to come within 10 yards of a keyboard, and most of them think a mouse is something you step on". Nevertheless, increasing competition, rapidly changing business environments, and more sophisticated and user-friendly systems are causing many executives to embrace computers enthusiastically).

### **EISs IN THE PERSPECTIVE OF TECHNOLOGICAL ADVANCES**

A continuous growth of the uses of EISs in organization e.g. in accounting sector has been taking place for last two decades. Organizations are becoming affordable and more executives are recognizing their usefulness by implementing EISs in the organization. According to one estimate, the total EIS market has grown from about \$1 million in 1984 to an estimated \$115 million by 1992 (Cortese 1989, 130).

An EIS expansion into personal computer (PC) based systems is responsible for some of this significant growth. Although most current EISs are mainframe based, PC systems command an increasing portion of the market as they become faster and more powerful (Paller and Lanska 1990; Kinlan 1992). Advances in technology have made today's PCs as powerful as the mainframes of a decade ago—at a fraction of the cost. PC hardware costs are decreasing sharply at the same time that dramatic increases in computing power, storage capacity, and speed are occurring. Often overlooked are significant improvements in communications capabilities among geographically dispersed computer systems. Dispersed, end-user computing is the wave of the future. As Larry Boucher<sup>6</sup> states: "[t]he central – processor model [mainframe] doesn't make sense any more. It has to change" (Verity 1990, 118).

Proliferation of desk-top personal computer has enabled vendors to mass-market EIS application software and distributes development costs among a greater multitude of users. Dozens of different PC software packages exist for both IBM and Apple systems.

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6. Larry Boucher is a former IBM mainframe engineer and co-founder and Chief Executive of Auspex system, Inc



Some of these packages currently retail for less than \$1000 (Pinella 1991; Kinlan 1992). These trends cause some to foresee an EIS market expansion "to include thousands of middle-level managers and other employees who make critical business decisions every day" (Pinella 1991, 26). As EISs become more affordable and sophisticated, these developments will likely expand the target market niche of developers from the fortune 500 companies into medium-size business entities.

### **THE ROLE OF ACCOUNTING AND EIS**

To run the organization smoothly, executives often required internal data and external data to take their decisions. For example, an accountant needs to see the performance of his/her organization with the forecasted sales of the year or to the competitors periodic divisional performance measures may be compared to reported industry results to evaluate sales, to highlight profit and market trends, and to plan courses of action to attain the company's objectives in response to recent developments. The maturation and widespread adoption of EISs will undoubtedly cause significant modification in the roles of accountants as more internal data are incorporated into these systems. Recognition of these changes and their resulting opportunities will enable accountants to increase their contribution toward successful EISs and executive decision making. Providing these services effectively could improve the power and prestige of accountants within organizations. Failure to anticipate and respond to technological advances, however, may result in lost prestige because of diminishing service to critical groups of internal decisions makers.

### **THE ACCOUNTING PROFESSION AND ITS HISTORICAL CRITICISMS**

The accounting profession has received harsh criticism for a perceived failure to provide appropriate information for managerial decisions (Johnson and Kaplan 1987). In recent decades, accounting standards-setting has focused almost exclusive on external financial reporting for large, complex business organizations.<sup>7</sup> Some believe this preoccupation with financial reporting has been at the expense of major improvements in meeting the needs of internal decision markets. Johnson and Kaplan (1987, 22) suggest that management accounting information has lost much of its relevance for executives.

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7. In fairness to the profession, this emphasis was at least partially in response to pressures from the SEC and Congressional committees. Increasing legal liability for independent auditors and the increasing complexity of business organizations themselves have also provided significant impetus for this action.

Driven by the procedures and cycle of the organization's financial reporting system, management accounting information is produced too late, too aggregated, and too distorted to be relevant for manager' planning and decisions. Critics have pointed the "finger of guilt" at accounting academicians for failure to advance managerial accounting's usefulness. Johnson and Kaplan (1987, 29) state: "Academics were led astray by focusing too narrowly on a simplified model of firm behavior."

Meeting Executive Information Needs to respond to some of the criticisms, the accounting profession must place greater emphasis on the identification, capture, storage, and organization of data that internal decision maker's desire and need. Moreover, this information must be (1) provided on a timely basis, (2) presented in an aesthetically appealing format, (3) relevant to the decisions at hand, (4) concise yet sufficient in scope to allow "what-if" analysis, and (5) flexible to interface with information from other functional unites.

Some accounting theorists propose a fundamental change from a value approach to an events approach (Sorter 1969; Johnson 1970; Lieberman and Whinston 1976; Benbasat and Dexter 1979) to improve the relevance of accounting data. These researchers cite the events approach's incorporation of more non-financial data into the accounting system and its greater emphasis on special-purpose reports as more responsive to information needs. Others have questioned its utility (Revsine 1970). Still other theorists advocating the events approach studied its practical application within the context of a database system (Colantoni et al. 1971; Haseman and Whinston 1976; McCarthy 1979, 1982, 1990). EISs require assimilation of data from diverse sources to generate an enterprise-wide database from which users can extract information relevant to the decisions at hand. These extracted data may cross functional boundaries within an organization and reside in the database in very rudimentary form, not just as summary data. To serve as a feed for the EIS database, accounting systems must possess the flexibility to interface with other information systems and they must provide data in detail as well as in summary form.

### **A PARADIGM FOR IMPLEMENTING AN EIS**

As a paradigm for implementing and maintaining an EIS, published accounts of successful companies provide a starting point for identifying and defining accountants' roles. A successful EIS implementation at the California-based North America Aircraft division of Rockwell International Corporation is described by David Armstrong (1990a

and 1990b). His company relied heavily upon (1) an EIS champion to promote the system and stoke the fires of interest, (2) a steering committee to create the basic plan and provide implementation guidance, (3) data providers and data keepers, (4) system developers to provide expertise for system analysis, design, and implementation, and (5) a project coordinator to assume responsibility for implementation, upkeep, and maintenance of the system. Armstrong further divides data keepers into two sub-groups—file keepers and program keepers. File keepers maintain and update the data within the system. Program keepers write and maintain application software to feed and process the data. Accounting personnel have expertise to perform in many of these capacities.

The controller or chief accountant is in an opportune position to serve as champion of an EIS implementation. His/her knowledge of the transaction processing and financial reporting systems provides a foundation for surveying and analyzing internal data to assess their content utility for executives. In the systems analysis phase, all systems development projects should include a critical analysis of extant data to assess its relevance for internal decisions. The controller or chief accountant should also possess a commanding knowledge of internal sources of critical financial and related data that executive's desire but are not being provided.

For reasons outlined in the preceding paragraph, the controller or chief accountant should serve as a member of the steering committee. Knowledge of accounting data and experience with financial forms and reports make the accountant a valuable consultant when designing computer screens, forms, and reports for the EIS. The steering committee often assumes responsibility for initial design of these outputs and spends considerable time investigating and analyzing existing reports (Armstrong 1990b, 74). Proper design is critical to effective executive use of the EIS. One of the greatest dangers with today's EIS is: "You can get a lot of very nice screens not pointing to the right things" (Pinella 1991, 30). Accountants' knowledge of financial operations and the transaction processing system provides the basis for identifying what is relevant because of their understanding of the data and its qualities. Understanding data is a key for determining relevance in an EIS (Pinella 1991, 30).

Auditors also represent an important component of the steering committee. The old saying "garbage in, garbage out" also applies to an EIS. Internal auditors, who possess a high level of knowledge about the control environment, the accounting system, and control procedures should be actively involved in the planning stages. Their early

participation should help ensure that the system includes adequate preventive, detective, and corrective controls and that the integrity of data is safeguarded. Companies may also want to include independent auditors in an advisory capacity to benefit from their knowledge of the company and to expedite future financial audits. Because of the critical importance of EISs to executive decisions, both internal and external auditors may be engaged to review or examine the quality of the system's outputs based upon its objectives and assertions.

Accountants also play an instrumental role as data providers. A data provider typically "creates, collects, maintains, analyzes or publishes information" (Armstrong 1990b, 78). In this capacity, the accountant defines source data for applications that convey information wanted by users. For example, when responding to a customer's request for a significantly increased credit limit, an executive might wish to review information about the account, such as payment history or an aging of the current balance. Additionally, data providers assume responsibility for care, input, maintenances, and accuracy of the data fed into the system. "Without the cooperation of the data providers, the EIS... cannot be effective" (Armstrong 1990b, 75).

Accountants also serve as program and file keepers. Most of the program keeping function, however, is currently performed by the EDP group. The EDP group frequently lacks understanding of the transaction processing system and often requires the assistance of accountants to obtain this knowledge. Furthermore, with today's PCs, electronic spread-sheets, fourth generation languages, and the trend toward end-user computing, a greater number of accountants are becoming involved in the program keeping function. Of course, accounting has always been responsible for the transaction processing system, including transaction preparation, file maintenance, and file keeping. With an EIS, the accountant's role also includes editing, reviewing, and testing data for accuracy, validity, and completeness. This expanded role occurs because of significant increases in the volume of data fed into the system for executive decisions. Moreover, these data may be broader in scope and may include non-financial data that have traditionally been considered outside the realm of accounting.

Greater Need for Timeless of Data Capture and Input EISs relieve accountants of many mundane processing chores that are time consuming when performed manually. The computer performs these tasks automatically. On the other hand, these systems increase the accountant's responsibilities with regard to the timeliness of data capture and input.

If an EIS is to function effectively, executives must be provided timely data. The frequency of updating an EIS database is commonly referred to as the *refresh rate* (Armsrong 1990b, 74). Careful analysis of data needs is critical when establishing refresh rate intervals that properly weigh the operational costs of updating against executive needs for timeliness.

### IMPORTANCE OF DIFFERENT EXECUTIVE DECISIONS

Categorizing different classes of executive decisions and defining accounting's roles in providing data for those decisions are extremely complex task. The work of Burchell et al. (1980) is a notable contribution that serves a useful basis for this analysis.<sup>8</sup> Derived from a model by Thomson and Tuden (1959), which classifies decisions under polar extremes of low and high levels of uncertainty relative to (1) objectives and (2) cause and effect, Burchell et al. identify four disparate roles that accounting may assume in practice:

- 1) Accounting as an Answer Machine-to provide information for reaching decisions by computations,
- 2) Accounting as an Answer/Learning Machine-to assist in decisions requiring judgment,
- 3) Accounting as an Ammunition Machine-to provide support for a decision requiring compromise, and
- 4) Accounting as a Rationalization Machine-to assist the decision process when high levels of uncertainty exist and inspiration is necessary to choose among alternatives.

Figure 1 reflects both research efforts by depicting the disparate decisions and accounting's roles under low and high levels of uncertainty. Note that a given executive decision, such as capital budgeting, may fall into any one of the four categories in this model depending upon the level of uncertainty. Consequently, accounting may assume multiple roles in a particular executive decision.

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8. Burchell et al. developed a model to assist in the sociological analysis of how systems are employed in practice. Although they did not imply that the typology should be used for analyzing roles in an EIS, we believe their model provides a useful framework for highlighting major categories of executive decisions and the corresponding roles played by accounting.

**Figure 1**

## Decision Making and Accounting's Roles Under Uncertainty

## Uncertainty of Objectives

Low

High

	Low	Decision by Computation	Decision by Compromise
		Role of Answer Machine	Role of Ammunition machine
Uncertainty of Cause and Effect	High	Decision by Judgement	Decision by Inspiration
		Role of Answer/Learning Machine	Role of Rationalization Machine

The discussion now focuses on using the model shown in Figure 1 to analyze examples demonstrating all four roles accounting can play in providing information for executive decisions. The foundation for this discussion is the premise that modern, complex organizations adopt multiple objectives, goals, and strategies that frequently conflict. The examples embody plausible sets of circumstances to illustrate the four types of decisions and the corresponding roles of accounting in two distinct areas—product costing and productivity analysis.

### OBJECTIVES AND GOALS: IS THERE ANY CONFLICT BETWEEN THEM?

Most companies adopt objectives of earning an acceptable profit both in the short and long run. The objective of short-run profit is often operationalized into goals of minimizing the cost of goods produced and selling products at the highest possible prices. The long-run profit objective may be operationalized by attempting to increase market share generally requires high quality goods to be produced and sold at competitive prices to ensure greater market penetration. Given today's competitive environment and the elasticity of demand for most goods and services, these short-and long-run objectives frequently conflict in most companies. Assessing the tradeoff between these objectives in order to establish, prioritize, and operationalized strategic goals will require information for all categories of decisions identified by Thompson and Tuden (1959). Furthermore, accounting information is important to each decision category, and provides an opportunity for accounting to serve executives in all four roles.

## **DECISION PROCESS AND THE TRADE-OFF**

Given the above assumptions regarding conflicting short- and long-term objectives, a company cannot maximize both profits and quality over the short and long run for a product with both high elasticity of demand and intense competition. Consequently, establishing targets for the selling price and level of quality will require an executive decision under high levels of uncertainty as to both (1) objectives, and (2) cause and effect. In this instance, the executive may make a decision by inspiration (see Figure 1) which maintains a rational corporate image and justifies and legitimizes the ultimate action taken.

In a large, complex organization, choices by inspiration are usually made jointly by two or more executives. The decision outcome is a function of the possible disparate preferences of the executives involved in the decision process and requires compromise. Each executive may have a unique utility function and may assign different weights to the relative importance of the competing short- and long- run objectives (Keeney and Raiffa 1976). Some executives will value quality more than short-run profitability and vice versa. As the executives are forming inspirational judgments independently, each will identify a tradeoff level to satisfy his/her own utility function. When group decision dialogue being, each executives will present a strategy consistent with his/her tradeoff level in an effort to persuade the others. As the interchange of strategies unfolds, a compromise decision is ultimately reached.

For an executive to establish his/her choice of a tradeoff level, judgments must be made about the relative importance of achievable profit and quality under different operational plans. Evaluating these choices may require information for managerial judgments based on sensitivity analysis of alternative scenarios. Accounting can provide data for the EIS which executives use to generate a variety of projected profit levels under different price, cost, and quality assumptions. Thus, accounting can perform the dual roles of an answer/learning and an ammunition machine. Availability of external data enables the EIS to also supply information on the industry and competition which can be used to assess potential market penetration under the various scenarios.

## **ACCOUNTING INFORMATION AND ITS ROLE IN PRODUCT COSTING DECISIONS**

Resolving the conflict between profitability in the short run and increasing market share in the long run requires a mix of both external and internal data for a rational decision.

Executives need information on product demand and elasticity, competing products and strategies, the economy, and a myriad of other exogenous factors. They also must consider endogenous factors such as the cost of manufacturing the product and tradeoffs that exist relative to different product quality levels under different cost assumptions. Some questions executives may raise are:

- What is the current level of quality and how does that level differ from the desired level?
- What is the current full cost of producing a unit and how does that amount differ from the full cost at the desired level of quality?
- What costs are variable over different level of product quality?
- What costs are controllable relative to producing and selling the products?

Accounting can provide data for definitive solutions to some of these questions by computation as an answer machine; for other questions, accounting can supply only ammunition for answers. Accountants can generate reasons (ammunition) to support executives' decisions.<sup>9</sup> For example, calculation of the average prime cost—direct material plus direct labor—of goods produced during a particular period is relatively objective, although some judgments may be necessary to distinguish between direct and indirect labor in today's complex manufacturing concerns. On the other hand, calculating average full cost requires making significant assumptions as to standards and production volume, distinguishing between variable and fixed costs, differentiating product and costs, and establishing an equitable policy for allocating indirect product costs.

Many internal decisions depend upon assumptions and measurements that require judgment and measurements that require judgment and may be subject to different interpretations. For example, to what extent should opportunity costs be considered in internal decisions relating to alternative uses of facilities? It is the relationship of the assumptions to the decision makers' preferences that determines accounting's usefulness as ammunition or a rationalization machine. In product costing decisions, issues involving appropriate cost and product quality tradeoffs are equally subjective and unlikely to have a unique interpretation.

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9. Here, accountants would provide explanations indicating why the selected course of action was chosen. An analogy is an expert system whose "rules of thumb" (If-Then-Else rules) provide a trail through the decision process that clearly indicates the criteria evaluated.



## **ACCOUNTING INFORMATION AND ITS ROLE IN MEASURING PRODUCTIVITY**

Accounting can serve an important role by providing data bearing on management's concern over productivity. In some instances, productivity issues require accounting to serve as rationalization machines to justify actions already decided by top management.<sup>10</sup> As an extreme but plausible example, management may have already decided to close a plant that is highly labor intensive and construct a modern facility in another region. The high labor cost of manufacturing the product in the extent plant was a key factor in the decision. The highly automated new plant will be able to produce the goods at a significantly lower labor cost and total unit cost. Because the plant closing will cause many workers to become unemployed and create a major economic problem for the community, management must justify its position to counter the community's negative reaction to the decision.

Management may use both internal and external information extracted from the EIS to show how productivity in the extend plant has declined in recent years. Accounting data can be retrieved from the EIS database to demonstrate how increases in unit labor costs over time have been primarily responsible for significant increases in the product's unit cost and have been damaging to the company's competitiveness by forcing increases in the product's selling price. Executives can also compare company sales (internal data) to industry sales trends (external data) from the EIS to project market share changes in response to changes in selling price.

External information may also be extracted from the EIS database to indicate how competitors achieve greater efficiency by using less labor and more advanced technology to manufacture a quality product at a materially lower unit cost. As a result, management may demonstrate that the competition is able to sell greater quantities of their product at lower prices. This information may provide justification for closing the unprofitable plant and opening a modern facility that will enable the company to be more competitive in the industry.

In a less extreme productivity situation where labor costs are critical, management may use accounting data as an ammunition machine to support their position in contract

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10. For more comprehensive examples of accounting in the role of a rationalization machine, see Burchell et al. (1985, 1980).

negotiations with labor unions. Accounting data could be used in sensitivity analysis to show the effects on unit costs and profitability of alternative settlement scenarios.

When supplying information for an EIS, accountants should be aware that executives often have different utility functions and preference that affect underlying assumptions. Thus, accounting data may be used as learning machines to make judgments or the data may be used as ammunition machines to support diverse views.

### **SUMMARY, CONCLUSIONS AND GUIDELINES FOR FUTURE RESEARCH**

Accountants can perform instrumental roles in the implementation and day-to-day operations of EISs. To achieve full potential, accounting must be able to interface efficiently with EIS databases and must be more responsive to data needs of internal decision makers. Accountants should be cognizant of the different roles that they and accounting data may assume to assist internal decision makers. Equally important is an understanding of the interrelationships among these roles and of the different types of decision processes used by executives for different classes of decisions.

Burchell et al. (1980) identify four roles that accounting can assume for disparate types of decisions: an answer machine, an answer/learning machine, an ammunition machine, and a rationalization machine. This paper uses examples to demonstrate that accountants can serve in several of these roles for a single, complex decision, especially when multiple conflicting objectives are present. The examples also provide an exploratory examination for these roles with regard to (1) product cost and quality, and (2) productivity. Additional research is needed on the use of these roles to explore the potential contribution of accounting of others classes of executive decisions in today's technological environment. Examples of relevant areas for this research include: capital and operational budgeting, divisional analysis and transfer pricing, make or buy, discontinuance of operations, and merger and acquisition decisions.

EISs and other advances in technology are rapidly absorbing the accountant's function as a processor of data in the role of a computation machine for decision involving low uncertainty. Such decisions are conducive to routine and programmable data processing activities and are prime targets for computerization. Furthermore, computer system and advanced modeling techniques are reducing the need for accountants as processors for learning machines. Consequently, if future accountants are to offer expanded services to internal decision makers, they will have to devote a greater portion of time in their roles

as ammunition and rationalization machines.

Accountants may have to become more oriented toward data that are broader in scope and traditionally considered outside accounting's domain. Much greater emphasis must be placed on special-purpose reports tailored to the particular needs of the executive for the decision at hand. Additionally, accounting system must be more flexible in order to interface better with system in other functional areas. As some theorists have advocated, a change to an events approach promises many significant advantages over the traditional value approach and may be more approach and may be more appropriate for meeting executive decision needs in today's technological environment.

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