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ACCOUNTING POLICY DETERMINATION:
A DECISION MODEL APPROACH

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate School of
The Ohio State University

By

James Howard Scheiner, B.S.B.A., M.B.A., M.A.

* * * *

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ACKNOWLEDGMENTS

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INTRODUCTION

The newly organized Financial Accounting Standards Board (FASB) confronts many important issues. Their decisions on these issues may determine whether significant accounting policy making will continue in the private sector. In response to this situation, the FASB has been urged to make their decisions on the basis of political considerations as well as on the basis of evidence disclosed by research studies.

Based upon concepts from industrial engineering and political science, a decision model will be developed in this dissertation consistent with available information about accounting policy making. Spatial analysis from political science is used to develop a mathematical programming decision model. This decision model will be shown to be more insightful than others now available for determining accounting policy. The information developed for mathematical programming will then be applied to accounting policy making situations, particularly with respect to the existence and type of optimal solution. In addition, methods of determining variables included in the decision model will be examined and evaluated.

1. For example see
In the first chapter, the history of private sector accounting policy making bodies which preceded the FASB is reviewed. The decision making process expected to be followed by the FASB is similar in two major aspects to that of its predecessors. The earlier policy making bodies did not seem to consider interrelated issues at the same time. They also did not have well defined explicit criteria for deciding among alternative policies.

The goals of accounting policy making are examined as they appear in the literature. A consistent goal of providing useful information has been expressed during the past several years. The decision making process of the FASB is evaluated in light of this goal.

The second chapter discusses individuals who have an interest in accounting information. Two groups of these individuals, suppliers and users of accounting information, are selected for analysis. One user group, investors, are examined using a decision model approach. Only in very restricted situations are two investors' preferences for accounting information similar. The environment of the accounting policy making bodies is further complicated by the differences between the preferences of suppliers and users for accounting information. Therefore, social choice methods must be explicitly considered by the FASB. Spatial analysis is introduced as a social choice method for accounting policy making. It is compared to other social choice methods.

In the third chapter, a decision model based upon spatial analysis using a mathematical programming formulation is constructed to improve the decision making process of the FASB. This decision model is compared to other alternative approaches for determining accounting policy that have
previously been suggested. The other approaches are unacceptable because they fail to take into account differences among interested individuals. The decision model as an objective function which takes into account the preferences of the interested individuals. Several formulations of the objective function are introduced which are consistent with the goal of accounting policy making. After the location of the best policy for the objective functions is considered, the decision model is expanded to consider constraints on the best policy. Variables included in the decision model are discussed. First the method of assigning weights to measure the importance of different individuals called the weighting method, is considered. The affects of different weights on the best policy are considered. Methods of determining the weights are examined. Also methods of determining individual preferences are considered. Multidimensional scaling is introduced as the best approach to providing this information consistent with the needs of the decision model. Since many methods are included under the classification of multidimensional scaling, these different methods must be considered.

The final chapter presents a conceptual and proposed empirical application of the decision model. The conceptual application is based upon the previous observations about accounting policy making. However, specific issues being considered are not identified. The formulations of the decision model are examined in this setting with respect to the existence and location of the best policy. Some of the formulations present results which are inconsistent with past observations. Another formulation which does not include these inconsistencies results in serious problems when the policy making body attempts to change the constraint set. A new formulation of the decision model to overcome this problem is considered.
Finally, the decision model is expanded to consider the possibility of changes in preferences over time. The proposed empirical application presents a use of multidimensional scaling techniques to investigate some of the areas that the decision model suggests are important. A questionnaire survey when analyzed would provide information needed for the variables of the decision model. In the final section, the benefits and potential problems of using the decision model are examined. Extensions, both empirical and conceptual, are proposed.
CHAPTER I
ACCOUNTING POLICY MAKING

Section I

U. S. Accounting Policy Making In This Century

In the early part of the twentieth century special committees were formed to investigate and determine accounting policy for specific problems. Since the 1930's the public accounting profession has attempted to set major accounting policy through three institutional groups, the Committee on Accounting Procedure (CAP), the Accounting Principles Board (APB) and the FASB. Accounting policy will be used to describe the decisions made by private sector organizations which govern the practice of public accounting. The policy decisions made by these three institutional groups have been called by various names. They have attempted to set policy through written comments which the accounting profession is obligated to follow. These binding written comments have been called Accounting Research Bulletins (CAP), Opinions (APB), Interpretations (APB & FASB) and Statements (APB & FASB). Other nonbinding methods have also been used. These include nonbinding written comments, speeches by members of the bodies and the publication of formal research studies. These three accounting policy making bodies have had no enforcement power on their own. The accounting profession's obligation to follow these
policy decisions are based upon the power of the American Institute of Certified Public Accountants (AICPA), the Securities and Exchange Commission (SEC), the stock exchanges and other regulatory agencies to require the profession to adhere to written comments on these policy making bodies.

Two earlier policy making bodies, the CAP and the APB, were replaced because of dissatisfaction with their accomplishments. The third, the FASB is too newly organized (1973) to have yet attracted much criticism. However, its problems are very similar to those faced by its predecessors.

The Early Experience

The early part of the twentieth century saw many events which had an effect upon the accounting profession. The tax law enacted in 1913 required a higher level of record keeping than was found previously. Furthermore the tax law focused attention on problems of accounting measurement. Other congressional acts established the Federal Reserve Board and Federal Trade Commission, both agencies needed better financial reporting in order to accomplish their mission. In the next decade, an article by William Z. Ripley, a Harvard economist, marked the start of criticism that had an impact on accounting policies. Furthermore the loss of confidence in the private sector by investors during the depression aggravated accounting policy problems.

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Three events occurred early in the 1930's which have had a significant impact on accounting policy making. Two interrelated events were the result of congressional actions. The Securities Acts of 1933 and 1934 established the Securities and Exchange Commission and stated explicitly that the government has the authority to determine accounting policy for companies which issue securities in interstate markets. The third event resulted from interaction between two private sector organizations. The American Institute of Accountants, forerunner of the American Institute of Certified Public Accountants (AICPA), and the New York Stock Exchange (NYSE) worked together on the preparation of Audits of Corporate Accounts published by the AICPA as a general statement of accounting policy. After this beginning, the AICPA was unable to continue to standardize accounting policy. In direct response to this inability of the AICPA to establish policy, the SEC started to issue Accounting Series Releases. Because of the fear that the SEC would exercise its authority to set accounting policy, the CAP was expanded.\(^4\) Between this time and 1959 when it was discontinued, the CAP was primarily concerned with determining policy for specific problems in accounting practice; such policies were established without undertaking major research studies.

The Securities Acts encouraged the accounting profession to establish policies. The SEC looked to the accounting profession to set policies. In addition, the Securities Acts greatly extended the potential liability of public accountants acting as auditors. In Ultramares\(^5\) the courts found that auditors were liable to third parties only for gross

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\(^4\)The CAP has as its predecessor the Special Committee on Procedure. The CAP was actually formed in 1930.

negligence or fraud. The Securities Acts extended liability to third parties for untrue statements. Furthermore criminal penalties are provided for filing false or misleading statements with the SEC. A defense available to accountants is that they exercised due care. Rules governing auditing and accounting policy would aid in the defense of any action brought for untrue statements.

The early period of the CAP's existence saw a change in emphasis in financial reporting. Until the early 1930's most of the AICPA's pronouncements were concerned with "small and medium-sized firms preparing statements for credit purposes." In the late 1930's the emphasis in accounting shifted from the balance sheet to the income statement. There appears to have been an increased emphasis on providing useful information to investors in publicly held firms.

For much of its existence the CAP worked largely without direct criticisms from outside organizations. However some objections to the way decisions were made and some of its decisions were expressed by individuals.

The plain fact remains that effective accounting rules are made in camera, without system, without effective submission to criticism, with little guarantee against arbitrary determination...

Also the CAP and the SEC did disagree on such topics as the redemption of preferred stock, income-tax allocation, quasi-reorganizations and the all-

---

inclusive vs. current-operating concepts of income. Notwithstanding these issues the SEC had a generally peaceful relationship with the CAP. Perhaps the minimization of disagreement was due in part to the influence of former SEC chief accountants who had become prominent in the AICPA. In its relations with another private sector organization, there was some disagreement with the Controllers Institute (the predecessor of the Financial Executives Institute - FEI) caused by a lack of consultation.

By the 1950's, this era of peaceful accord had ended. Attacks on the CAP increased substantially throughout the decade. A new chief critic, Leonard Spacek, a prominent public accountant, charged that accounting policy making by the CAP was ineffectual. Increasingly the opinion was expressed that research should be used in establishing accounting policies to ensure that policies were consistent.

In 1957, in response to mounting criticisms, a special AICPA committee on research was formed. In less than a year the committee published a report suggesting that the CAP be replaced by the APB, and that research be expanded to help determine accounting policy; approximately one year later, 1959, the APB and a new Accounting Research Division were organized.

A Second Attempt: the APB

Reacting to criticism of its predecessor, the APB initially decided no policy decisions would be issued until research on the specific policy subject was completed. During the first year of the APB, the research division commissioned eight formal research studies. Many of these studies were long delayed before being completed. However the results of

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9 Specific examples are Carman Blough and William Werntz.
10 Zeff, Forging Accounting Principles, p. 145.
the first research studies completed did not appear to meet the needs of the APB since they did not seem to influence policy decisions. The APB seems to have decided after all that research was not particularly helpful in solving the problems it faced. Fewer research studies were commissioned. The APB also started to issue policy decisions, called opinions, in response to specific problems often without prior research studies. This procedure led to difficulty almost immediately with Opinion No. 2 on the investment credit. Pressure from government, industry and the SEC forced the APB to later accept an alternate method of accounting for the investment credit.

The Events of the 1960's

By the early 1960's, others over whom the APB exercised no authority became interested in their accounting policy making. The ability to influence others without relying on theory or empirical research became important. Political power became more important in determining accounting policy. Sterling has suggested:

In short, the lack of progress in agreement upon accounting...[policies] and the lack of ability to institute accounting reforms cannot be explained on the grounds of logic. However, when we look at the progress of accounting in the context of a power struggle the explanation is obvious.12

Horngren has indicated that:

...the setting of accounting standards is as much a product of political action as of flawless logic or empirical findings. Why? Because the setting of standards is a social decision.13

Horngren presented a diagram (Figure 1) to summarize the political position of the APB to government bodies and the U. S. Congress.14

![Diagram](attachment://figure1.png)

**Figure 1** The Environment of the APB

Starting in the 1960's, perhaps as a direct result of the controversy surrounding the investment credit, the accounting profession and its accounting policies became an important news subject. Abraham Briloff, both an academic and practicing accountant, perhaps replaced Spacek as the leading critic of accounting policies. The SEC exerted much pressure on the APB to resolve important policy issues. Other nonregulatory bodies also became interested in APB decisions.15 But by the mid 1960's the APB did achieve policy solutions which did not result in conflict on pensions, tax allocation and extraordinary items. These areas had been considered earlier by the CAP without success. In one case the APB came to accept

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the type of income statement which the SEC had supported to the CAP. However, the determination of new policies on business combinations and goodwill brought on controversy which proved fatal to the APB. Market conditions once again were causing the investor to lose confidence in the private sector. Penn Central and Equity Funding were two financial scandals among a number in which accounting policies were questioned.

A Third Attempt: the FASB

By the late 1960's comments regarding the APB seemed to center on the following major criticisms. Some critics felt that the APB was still following the practice of the CAP in considering policy issues on a problem by problem basis. There was also criticism about the APB's structure. The APB was alleged to be unrepresentative of all those having a major interest in its decisions since most of the members were practicing public accountants. These part-time members were alleged not to be independent because of their close ties to clients. The nature of the APB policy decisions was also questioned. Some pointed to the lack of empirical evidence or logical justification in its policy pronouncements.\(^\text{16}\) This situation might have been partially the result of the nature of research undertaken to support the APB. The authority of the APB to require the profession to adhere to its opinions was sometimes questioned.\(^\text{17}\) Furthermore, the APB's slow speed in reacting to changes in business and financial affairs was attacked.

\(^{16}\)Zeff in Burns, Accounting in Transition, p. 9.
All too often it has failed to recognize and deal with accounting problems in time to prevent them from becoming front page topics in the financial press.\textsuperscript{18}

Finally the inability of the APB to deal politically with those outside the accounting profession should not be forgotten or underestimated. Seidler suggested that

Neither the friends nor the critics of the APB could fail to note the degree to which political realities exerted an influence on the operations of the Board. While there were many factors responsible for the ultimate downfall of the APB, the politics of its environment, coupled with the Board's dismaying political naivete, were among the most significant causes.\textsuperscript{19}

In response to these criticisms the AICPA in 1971 organized two committees to investigate the operations of the APB and the objectives of financial statements. These committees were referred to as the Wheat Committee and the Trueblood Committee after their respective chairmen. The Wheat Committee recommended that a new independent private sector organization be established to set accounting policy. Due to its charge, the Wheat Committee paid scant attention to the mission of the FASB. Its report is devoted to organizational arrangements..., methods of financing the operation and the like.\textsuperscript{20}

The Trueblood Committee report was not completed until several months after the founding of the FASB.


The FASB was formed to overcome many of the problems faced by the APB. The FASB has a smaller membership and all members are full time. In a sense the FASB has wider representation and is more independent than the APB. Only four practicing public accountants serve on the FASB at a time. The other three positions are currently filled by individuals whose backgrounds are in education, financial management and regulatory accounting. A member of the FASB has stated

In comparing the FASB with its predecessors...two features dominate all others. I refer to the small full-time independent FASB membership and to the broad participation in FASB activities.21

At least two professional groups which have a major interest in financial reporting are not directly represented on the FASB. Financial analysts or, those who use the statements for investment purposes are not represented. Economists, notwithstanding the economic impact of many accounting policies, also are not represented on the board. The FASB is somewhat more independent of the AICPA than was the APB; all FASB members are named to the FASB by the Financial Accounting Foundation (FAF) rather than by the AICPA.

Organizations Directly Related to the FASB

The function of the Board of Trustees of the FAF is to obtain financial support for and appoint members to the FASB. The nine members of the Board of Trustees includes five representatives from the AICPA and one each from the American Accounting Association (AAA), the Financial Analysts Federation, FEI and the National Association of Accountants

(NAA). According to a member of the FASB, once appointed
'FASB members...have virtually no contact with the Board of Trustees.'

The Board of Trustees also appoints the Financial Accounting Standards
Advisory Council. The twenty-eight member advisory council meets quarterly to advise the FASB regarding items on the FASB agenda and proposed interpretations of existing accounting policies. Some of the work of the advisory council is going to be taken over by a new committee.

The FASB is planning to institute a fifteen member screening commit­
tee on emerging accounting problems. The tentative purpose of this new committee is to advise the FASB on

1. the merits of problems and the time frame for responding.
2. the type of response needed for a particular problem.
3. the appropriate organization to examine the problem.

Some believe that the FASB should be viewed as a legislative body while others view it as a judicial body. The FASB's use of the new screening committee may give some indication of whether it will act as a legislative or judicial body.

The FASB has instituted a task force concept to examine accounting

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23Over two years ago Sortor predicted because of the political situation of the Advisory council that it would be eliminated. George H. Sorter, "Comment by George H. Sortor," in David Solomons, Financial Accounting Standards: Regulation or Self Regulation, (Stanford, California: Graduate School of Business, Stanford University, 1972).
policy problems. Task force members are not restricted to those belonging to any particular groups. With these interested individuals, a task force's purposes are

1. To refine the definition of the problem and its financial accounting and reporting issues.
2. Determining the nature and extent of research.
3. Developing a discussion memorandum...[that includes] alternative solutions and the arguments and implications related to each solution.26

The direction of research has also changed from the general to the specific and from a conceptual to a more emphatic problem-solving orientation.

Research generally will be directed to specific issues associated with FASB projects. It will have a problem-solving orientation and will be directed to providing information about specific questions and the impact of alternative solutions.27

The FASB Environment

Despite these changes some argue that the FASB is basically in the same relative position as the APB.

In my opinion the FASB has no better chance of living up to what the financial world and the general public expect from it than did the APB...My scepticism about the future of the FASB is based largely on my strong feeling that the APB's main problems were not structural; rather, they were conceptual.28
The FASB is currently operating without a formal statement of its objectives, although it has started the process of considering this topic. Also the relationship of practicing public accountants to the policy making body is basically the same, namely one of domination. Yet the interest of nonprofessionals in policy determination continues and even increases.

The interest of nonprofessionals in accounting can be considered the result of events and changes in philosophy that have occurred in the twentieth century. As a noted historian indicates Americans have become "income-conscious." Income is used as a basis for many decisions. In response, "accounting became at home in the inner sanctums of large corporations, they not only shaped corporate accounting procedures but guided crucial decisions of policy." Furthermore, Americans expect even the income reported to taxing authorities to be "fair and honest." This is in contrast to situations in other countries where it was a newsworthy event, and not necessarily one that improved a reputation, if a man filed a full and honest tax return.

Americans have come to distrust bigness and secrecy. Americans demand to know the circumstances surrounding the decisions that affect them. Individuals view alternatives in a decision making situation from an advocacy point of view. If decisions do not meet their expectations, individuals may search for redress. Increasingly this redress has been to the courts. With these changes in the American environment, accounting

policy making procedures would be expected to change. The setting of accounting by quiet negotiation that was acceptable in the 1930's and still is acceptable in other countries seems increasingly to be no longer acceptable to interested individuals in the U. S. 31

The political situation seems to be considerably more complex than was indicated by Horngren (Figure 1) since political influence really starts with the electorate. The additional influences, summarized in Figure 2 cannot be overlooked.

![Figure 2 The Environment of the FASB]

Moonitz has suggested:

31 This difference between policy making in the U. S. and Great Britain is pointed out by Zeff, Forging, pp. 307-320 and in Burns, Accounting, pp. 21-23 & 29-31.
19.

The informal relation existing between the SEC and the American Institute (AICPA) has promoted the success of the process when other affected parties...have not intervened. When this intervention has occurred and the SEC's position either was unclear or appeared to be subject to change, the accounting profession was effectively undercut.32

The electorate also are members of various business firms and independent organizations which attempt to influence accounting policy making. Among those included as independent organizations are the AAA, NAA, AICPA, FEI, Financial Analysts Federation, Robert Morris Associates and various industry trade associations. In recent years at least one of these organizations, the FEI, has indicated "that they should have a more direct voice in the formation of accounting policies."33

The Federal Courts have an important influence on the accounting profession and the FASB because they ultimately decide questions about interpretation of the Securities Acts. The trend in court decisions34 relative to these acts has been to reject accounting policy as the sole standard for providing acceptable information. Causey suggests that there has been a gradual evolution from accounting policy to a standard of usefulness

33Charles T. Horngren notes this in Burns, Accounting in Transition, p. 96.
investors as the major criterion for making decisions regarding disclosure. Before being appointed to the SEC a noted lawyer stated that two basic concerns of the courts are that "financial statements fairly and meaningfully inform the investor...[and] that they have intelligibility to the layman."36

The SEC and the FASB

The relationship between the FASB and SEC is particularly important. Under the Securities Acts, Congress has given the SEC the primary responsibility for determining accounting policy. For most of its history the SEC has been willing to let private sector organizations actually determine accounting policy. This may not be true in the future. In a recent speech the Chairman of the FASB stated

For the first time in its 40-year history the SEC is now doing more in the way of establishing accounting policy than is the private sector.37

A compromise appears to have been developed to settle the initial difficulties between the FASB and SEC. Some feel that this compromise has placed the FASB in a leadership position subject to the acceptance of any policy by the SEC.

When and if the FASB moves too far out or in the wrong direction the Commission [SEC] is prepared to jerk on it quickly.38

35Denzil Y. Causey, Jr. Duties and Liabilities of the CPA, Studies in Accounting No. 5 (Austin, Texas: Bureau of Business Research, University of Texas at Austin, 1973).
36A. A. Sommer, Jr., "What are the Courts Saying to Auditors?" Howard F. Stettler, Ed., Auditing Looks Ahead, (Lawrence, Kansas: School of Business, University of Kansas, 1972), p. 33.
38As cited in Anreder, "By the Numbers," p. 27.
The SEC is advocating that its concern should be the disclosure of accounting information, while the FASB's concern should be accounting measurement. The FASB has voiced strenuous objection based upon the belief "that disclosure of financial information is an inextricable part of establishing accounting standards." However, if the SEC's position is eventually accepted, the FASB will be responsible for making decisions which are more costly to implement than changes in disclosure. More disagreement about changes in accounting measurement can be expected than about changes in disclosure. Therefore, the FASB could potentially be in a far more difficult situation than its current one.

Congress and the FASB

The role of Congress in setting accounting policy must also be considered. In at least one case, involving accounting for the investment tax credit, Congress has legislated accounting policy. Furthermore Congress even without enacting legislation may have an influence on accounting policies. For example, Congressional hearings into or expressions of interest in certain accounting policies even without legislation may lead the SEC to act. Skousen considers the hearings of the Antitrust and Monopoly Subcommittee of the Senate Judiciary Committee on Economic Concentration to mark the beginning of the segmental disclosure debate.

40Chapter II, Section II discusses the costs and benefits to suppliers of requirements for additional accounting information. The differences in cost are summarized in Table 11.
If groups feel that they can benefit from taking their case to Congress then it appears they will. Recently the Chief Accountant of the SEC, stated:

Those opposed [to lease capitalization] sense that they have lost the battle in the accounting profession and they are now looking to Congress. [It is important that the FASB] be prepared to make a case to Congress.43

Furthermore Congress may be willing to listen seriously to these complaints. Letters have been sent by congressmen to the FASB and SEC. A congressman, in response to the issue of leases indicated a hope that

Decisions would not be based on the theoretical niceties of accounting principles but rather on the realities and on economic costs and benefits.44

The threat of government intervention, either by the SEC or Congress, appears to have a higher probability today than at most times in the past.

Summary and Conclusions

The setting of accounting policy by private sector organizations has evolved since the beginning of this century. The FASB is in a far more complex political situation than its predecessors since the individuals and the groups interested in accounting policy have expanded and have become more vocal. Furthermore, governmental organizations which have explicit authority to set accounting policy have indicated a willingness to start

to do so. In response to this evolution private sector accounting policy making bodies have been completely restructured twice in an effort to correct problems. The latest of these bodies is the FASB. In an effort to provide input outside the accounting profession, public accounting membership on the FASB has been reduced. This effort is furthered through the task force concept and public hearings. However, those who have an interest in accounting policy making may be unwilling to wait for results from the FASB as long as they did for the CAP and APB. Furthermore the failures of the last private sector policy making body, the APB, are so recent as to cause doubts about the political effectiveness of any private sector policy making body. In light of these criticisms of the private sector organizations, the goal of accounting policy making will be examined in the next section.

Section II

The Goal of Accounting Policy Making

The Trueblood Committee stated that "the basic objective of financial statements is to provide information useful for making economic decisions." 45 APB Statement No. 4 stated that the "basic purpose of financial accounting and financial statements is to provide financial information about individual business enterprises that is useful in making economic decisions." 46 Although this objective has been considered throughout the


history of accounting literature in the twentieth century, it has not appeared in official pronouncements of public accountants until recently. Paton (1922) stated that accounting's function is "the preparation of important financial statements for the use of managers, investors, et. al." Arthur Andersen & Co., (1965), one of the "big eight" public accounting firms, stated

An important criterion to be considered in establishing accounting principles is that of fairness - fairness to all segments of our society (such as stockholders, management, labor, creditors and customers.)

In any event there does seem to be some official recognition that the goal of accounting policy making is to determine policies which provide this information although this goal has not yet been officially accepted by the FASB.

The Interpretation of the Goal

For most of U. S. accounting history, this goal has been operationalized as trying to find the most accurate or precise items to report.


The committed theorist is concerned with the search for truth. The purpose of research is to discover truth...\(^{49}\)

Other authors feel this method of determining accounting policy should be called the "historical communication approach" for

The approach aims at producing a unique set of historical information for all purposes. The objective is to use measurement rules that supply unambiguous information in the sense that only one measurement system is acceptable.\(^{50}\)

Accepting the historical communication approach requires a suppression of individual differences. Individuals may not perceive the information in the same way. In addition their costs of processing may be different. So the net benefits from the information may be unequal.\(^{51}\)

The literature in the 1960's began to suggest that accounting policy making must be concerned with different individuals. Perhaps this was the result of the increased awareness of the problems of allocations of costs that are joint with respect to products and time periods. Thomas indicated that there is no conclusively defensible way to allocate inputs.


\(^{51}\)See Chapter II, Section 1.
Furthermore, "financial accounting cannot be neutral with respect to conflicts among its users because it usually cannot provide mutually satisfactory allocations." Stone argues that the primary consideration in setting accounting policy should be to fulfill the needs of the dominant or largest user group. Abdel-khalik considers a fundamental question for accounting policy making:

Should a piece of information be judged relevant because the accountant perceives it to be or because the user prefers it? The former would appear to be an imposition of norms which violates the law of users' sovereignty.

The recent recognition of the political nature of accounting policy making may be interpreted as recognition of the inability of the historical communication approach to satisfy individual differences. If one can no longer consider the historical communication approach as the method of deciding accounting policy, Gerboth believes that an individual's confidence in the "fairness of accounting's rule-making tribunal" will determine their acceptance of specific policies. Over fifteen years before Gerboth's comments, Spacek suggested a "court of accounting principles" to achieve fairness to all interested.

individuals. According to one author the APB tried three unsuccessful approaches to accounting policy making:

1. finding "truth,"
2. finding acceptable alternatives
3. legislating "truth." 

Apparently, in order to survive, the FASB must seemingly use an approach other than the historical communication approach.

The goal of accounting policy making has been expanded. Horngren states that the goal of accounting policy making is "(or should be) the maximization of society's welfare' in the form of optimal financial reporting to investors." The importance of accounting to society has become a concern of public accountants. The successful accountant of today has been described as one who

...must be aware of what his social responsibilities are as a professional man so that he is continually working to upgrade the standards of his profession... and must appreciate the points of view of the various interests in the data he strives to produce or review.

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58 Bedford suggests that the Trueblood Committee is an example of the acceptance of a "pragmatic political approach" to accounting policy making, Norton M. Bedford, "Comments by Norton M. Bedford," in Sprouse, Establishing, p. 22.
60 R. K. Mautz, "Where Do We Go From Here?", The Accounting Review, April, 1974, p. 359.
However, as can be seen from previous comments, investors are not the only ones who have an interest in financial reporting.

Outsiders will not stand idly by and permit the organized accounting profession to set those standards by itself. Outsiders have a continuing and abiding interest in all phases of the process by which accounting standards are set. 61

The opinions of all interested individuals or groups of individuals must be considered in setting accounting policy even if certain individuals may be given more consideration than others in determining accounting policies.

It [accounting policy] may fall short of giving any group in the society, indeed any individual, precisely what he thinks is ultimate truth... a standard [policy] may be nothing more than the best compromise that can be reached at the time and under the existing conditions. 62

The relative importance of individuals is to some extent based on considerations which might be considered political in nature.

When you use the term "political influence," it has evil connotations; yet in a democratic country, all regulatory agencies...are subject to inquiries and suggestions... The important thing is how all regulatory agencies are equipped to deal with these political influences. 63

The Goal and The Current Environment of Accounting Policy Making

The environment of the FASB and SEC as accounting policy making bodies is complex. The policy making bodies are between the firms which supply

61 Moonitz, Obtaining Agreement, pp. 63-64.
63 Charles T. Horngren, as quoted in Burns, Accounting in Transition, p. 96.
accounting information and those who use the information [Figure 3]. In order to receive increased information the users make their requests to the policy making bodies and sometimes to firms directly. Firms also request changes in information. These requests are indicated by the lines marked "A." The actual information flow is shown by "B." Some of the information, the annual reports for example, are examined by public accountants. Other information is provided directly to users. An attempt is underway to reduce some of this direct information. The SEC has attempted to reduce the information which is supplied to only certain individuals, financial analysis for example, and not to other users. The SEC also wants public accountants to examine quarterly financial statements. Finally there are checks (indicated by "C") to determine if the information provided to users meets the policies set by bodies. Violations may cause criminal, civil or professional penalties.

Figure 3 Accounting Information Suppliers and Users

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The goal of providing information that maximizes the benefits of interested individuals is complicated because of the different groups of individuals that are interested in accounting information. Recently, a growing realization has occurred that certain groups of interested individuals place constraints on the ability of the FASB to provide beneficial information to users. Therefore cooperation becomes important in order to provide the most beneficial information possible.

Practitioners are continually responding to changes wrought by others, many of which they consider undesirable...The practitioner becomes a compromiser because that is the only way he can have any real impact at all - and then only after a lengthy and time-consuming process.

In the next section, the FASB's ability to meet this goal is examined.

Section III

The FASB and Its Goal

Financial statements according to the Trueblood Committee are particularly important to those having limited access to other types of information. The importance of these investors has been expressed by the SEC. In 1947 it stated

Even if [all significant data] had been given there is an additional obligation to present the material in a way in which it will be useful to the informed but less sophisticated readers.

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66 Mautz, "Where Do We," p. 354.
67 Accounting Objectives Study Group, Objectives, pp. 13-17.
68 Sommer, "What are," p. 33.
Recently the Chairman of the SEC stated that "a significant portion of our efforts has been, and will continue to be, devoted to obtaining adequate information for the investor." The federal courts also appear to be concerned with "the man on the street." Seemingly the FASB should be concerned with these individuals.

Although the relative importance of individuals might be influenced by political considerations, research studies can provide information which can be used in deciding political questions. Research can be used to help classify individuals. For example, research can be undertaken into the characteristics that make individuals unsophisticated investors. There is a lack of empirical information in accounting about unsophisticated investors. The concern of the accounting policy making bodies, about differences among investors should be reflected in accounting research. Many articles have implied that annual reports do not aid most investors. Yet such statements are being made without any classification of investors. For example, the FASB considers unsophisticated investors to be those who are "relatively unschooled in financial affairs." One wonders if this requires the absence of both formal and practical training. Or can one type of training be substituted for another?

Some research has implied that accounting policy making should be less concerned with the effects of different accounting information on investors. Several studies have supported the view that the securities market "as manifested in the way in which security prices react, is quite sophisticated in dealing with financial statement data." This view is commonly called the efficient market hypothesis. This approach deals with the securities market as a whole. The FASB must deal with different groups some of which are involved in the securities markets. What is acceptable to the market as a whole may not be acceptable to different groups. For example, the nature of the securities markets gives anyone who can process information faster, a better position over others. Seemingly individuals who can not process certain information quickly may object to providing that information. Even if the efficient market hypothesis is accepted, there is still concern for differences among users. This is in accord with a recent study which concludes based upon their theoretical analysis and the review of empirical work...that available evidence [on market efficiency] cannot be used to fully resolve the main issues with which the [accounting policy] making bodies deal (i.e., conditions under which different accounting techniques should be used). 

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73 Beaver, "What Should Be The FASB's Objectives," p. 50, Beaver also presents a brief review of the empirical studies and theoretical literature on the efficient market hypothesis. 
74 This is discussed in Chapter II, Section I. 
Information Provided to the FASB

The procedure used for developing accounting policy by the FASB and its predecessors omitted these unsophisticated investors from direct consideration. Those who have provided input to the policy making bodies are for the most part those who produce financial statements or typically users of financial statements who have access to a larger amount of information than most other users. The resources required to submit detailed comments to the FASB preclude those who the Trueblood Committee felt are most important. The comments from interested organizations, and accounting researchers are the only ways that the views of individual investors can be heard. Often these comments are concerned only with the impact of specific standards on a single organization, a special industry or on the market as a whole and not with the impact of specific standards on individual investors. For example, the comments made by the insurance industry during the public hearings on the valuation of marketable securities were concerned only with the impact of the valuation procedure on the industry.76

During 1974 the FASB received over 1500 responses to its discussion memoranda and exposure drafts. Table 1 indicates the sources of these responses.77

76For an analysis of this situation see Horngren, "Marketing," pp. 63-64.

Table 1. Sources of Comments Received by FASB

<table>
<thead>
<tr>
<th>Source</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>65.6</td>
</tr>
<tr>
<td>Public Accounting Profession</td>
<td>16.8</td>
</tr>
<tr>
<td>Academics</td>
<td>7.2</td>
</tr>
<tr>
<td>Government</td>
<td>4.1</td>
</tr>
<tr>
<td>Securities Industry</td>
<td>2.5</td>
</tr>
<tr>
<td>Banking Industry</td>
<td>2.4</td>
</tr>
<tr>
<td>Others</td>
<td>1.5</td>
</tr>
</tbody>
</table>

One reason for the high percentage of responses by industry is the information about FASB operations and the encouragement to respond received from independent operations. For example, the NAA, whose members generally are closely associated with managerial accounting, has been exhorting its members to respond to the FASB. In a recent issue of their monthly publication, Management Accounting, three articles dealt with issues the FASB was considering. Also public accounting firms are keeping their clients informed about issues being discussed by the FASB and are urging them to respond to the FASB. Furthermore, the time required to respond to FASB request for comments discourages those with limited resources from responding. One public accounting firm states that the time required to respond to the FASB on one issue "involved a great many ... man hours and covered a period of months."

Selection of Accounting Policy Issues For Consideration by the FASB

The determination of accounting policy on a problem by problem basis, as has been done in the past, may lead to less desirable long-run solutions for the interested individuals. The policy alternative accepted for one issue may affect policy decisions on all future issues. For example, assume policy alternatives A & B are available for Issue #1 and X & Y are available for Issue #2 and the preferences for all individuals are indicated in Table 2.

Table 2. Preferences for Alternatives

\[
\begin{align*}
(A \rightarrow Y) &> (A \rightarrow X) \\
(B \rightarrow X) &> (B \rightarrow Y) \\
(B \rightarrow X) &> (A \rightarrow Y) \\
A &> B
\end{align*}
\]

where \( \rightarrow \equiv \) then

\( > \equiv \) preferred to

If the FASB considers only Issue #1 first and then considers Issue #2, it will select A \( \rightarrow Y \). However B \( \rightarrow X \) is preferred to A \( \rightarrow Y \). Therefore by considering each of the issues separately at a minimum the FASB might have to reconsider its prior decisions. This reconsideration might cause a reduction of confidence in their decisions. The first nine problems being considered by the FASB (Table 3) reveals issues which have a long history in accounting.\(^81\)

Table 3. Initial Task Force Assignments of the FASB

1. Foreign currency translation.
2. Leases.
3. Research and development start-up and relocation costs.
4. Accruing for future losses.
6. Reporting by diversified companies.
7. Broad qualitative standards.
8. General price level reporting [added later].
9. Business combinations [added later].

An algorithm for examining issues is needed to guarantee that there will be convergence to an optimal solution from the current set of policy alternatives in a minimum time period. Some disciplines have such assurances. In mathematics, algorithms are available for certain types of problems which allow the achievement of an optimal solution by considering variables individually.

In fact the accounting policy making bodies at various times have considered policy alternatives instead of policy issues. The general valuation issue suggests a number of alternatives. Yet the FASB is currently considering only one alternative, price level adjusted statements. The examination of one alternative at a time for a policy issue can require a longer time to achieve an optimal solution.

In theory the issues faced by the accounting policy making bodies are typically interrelated. For example consider the general valuation issue and the valuation of business combinations. If current valuation is used for general valuation purposes, the distinction between the purchase and pooling treatments of business combinations would be

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82 See Chapter IV, Section II.
Materiality commonly is thought of in terms of whether the disclosure of a matter or the accounting treatment of it is either necessary for a reasonable overall understanding of an enterprise's financial statements or likely to influence the conduct of a prudent investor.

Therefore the criteria for determining materiality might be used in selecting those issues and alternatives that the FASB will consider. Furthermore objectives should be used in selecting from among the alternatives to a policy issue. Attached to every alternative is the question of how much to disclose in the financial statements.

All issues might be considered interrelated since all policy issues are related to the goal of maximizing benefits to interested individuals. It is necessary, therefore, to determine whether the interested individuals actually do consider certain issues interrelated.

Section IV

Summary and Conclusions

The goal of accounting policy making bodies is to provide information

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83 Business Combinations accounted for by purchases result in the revaluation of the assets of the purchased firm. Those accounted for by pooling consider that the interest of both firms continue in the combined one. No revaluation results in this case. For a discussion of these two methods as alternatives to solving this problem see "A.P.B. Opinion No. 16 - Business Combinations" as printed in APB Accounting Principles as of June 30, 1973, (New York: American Institute of Certified Public Accountants, 1973) Vol. II, p. 6640.

that maximizes the benefits to interested individuals. The problem faced by the FASB is to evaluate the desirability of accounting policy alternatives for all interested individuals. Based upon the evaluation, a policy alternative is selected. The increasing interest in decisions of accounting policy making bodies that has occurred over time can be seen as a recognition by those outside of accounting of the importance of these decisions. In response to this increased interest the FASB is using a task force approach and public hearings. Furthermore the importance of political considerations in setting policy is being expressed.

Research disregards politics and the other compromises necessary in making decisions... Decision-makers should acknowledge the political and other required compromises [and] explain their decisions on pragmatic grounds...85

Only recently has it been suggested that policy decisions be considered from points of view other than the historical communication approach.

I hope that the 1970's sees some concentration on the optimal method for wielding accounting policy in a democratic society. The literature of organizations, political action, social change and social choice may be more closely related to the development of accounting standards than we have been willing to admit.86

The concern with political factors may be a recognition that accounting policy making involves problems faced in any social choice situation.

When a decision-making process depends for its success on public confidence the critical issues are not technical, they are political.87

85 Arthur Wyatt quoted in Burns, Accounting in Transition, p. 128.
86 Horngren, "Marketing," p. 66.
The FASB was organized to overcome the objections voiced about the APB. However, there is some question whether the FASB has changed enough to meet the increased demands from outsiders.

Perhaps, the problems faced by accounting policy making bodies are the result of the particular environment in which they operate. Accounting policy making bodies cause individuals to allocate their resources without traditional market mechanisms to determine the quantity or price of these resources. Potential differences among these individuals have been briefly discussed in this chapter. In the next chapter preferences for accounting information are examined for different interested individuals. Due to these differences, social choice mechanisms for determining accounting policy are considered.
CHAPTER II

Social Choice and Accounting Policy Making

Accounting policy making's goal of providing information that maximizes the benefits to interested individuals has caused accounting to consider itself from new perspectives. The criteria for deciding among accounting policy alternatives can represent a surrogate social welfare function.\(^1\) When accounting policy alternatives are viewed as an information choice problem without cost, the alternative selected for the policy affects many individuals. Therefore a trade-off among individuals may be required.\(^2\)

This chapter examines the environment of two groups of interested individuals, suppliers and users. The first two sections present a discussion of suppliers and users of financial accounting information. Different investors, except in very restricted cases, have different preferences for information. Furthermore those who supply accounting information incur most of the costs. The users obtain most of the benefits. The environment of financial accounting makes the choice of policy alternatives a social choice situation in which comparisons among individuals is required.


40.
In the final two sections, social choice methods for accounting policy making are considered. Certain social choice methods suggested for use in accounting have significant limitations for this particular application. Spatial analysis is introduced as a social choice method for accounting policy making which allows the explicit consideration of individual preferences. The assumptions of spatial analysis and their relationships to accounting policy making are shown to be basically consistent.

Section I

Users of Financial Accounting Information

Financial statements have been considered as general purpose reports designed to serve the needs of many users. APB Statement No. 4 suggested that users be classified as those who have a direct interest in business decisions and those who have an indirect interest (Table 4).

Table 4 Interested Users

<table>
<thead>
<tr>
<th>Direct Interests</th>
<th>Indirect Interests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owners</td>
<td>Financial Analysts and Advisors</td>
</tr>
<tr>
<td>Creditors and Suppliers</td>
<td>Stock Exchanges</td>
</tr>
<tr>
<td>Potential Owners, Creditors and Suppliers</td>
<td>Lawyers</td>
</tr>
<tr>
<td>Management</td>
<td>Regulatory or Registration Authorities</td>
</tr>
<tr>
<td>Taxing Authorities</td>
<td>Financial Press and Reporting Agencies</td>
</tr>
<tr>
<td>Employees</td>
<td>Trade Associations</td>
</tr>
<tr>
<td>Customers</td>
<td>Labor Unions</td>
</tr>
</tbody>
</table>

Financial statements are used to provide financial accounting information to those indicated.

"Basic Concepts and Accounting Principles," pp. 9067-68.
In an alternative classification, Kenley and Staubus consider users as shareholders, lenders, suppliers, customers and others.\(^5\) Since the APB statement includes more potential users, it will serve as the basis of discussion.

Some of those considered as users have access to information in addition to financial statements. Management is both a supplier and user of financial accounting information. They will be considered in the next section on suppliers. Tax authorities, regulatory or registration authorities, stock exchanges, financial analysts and certain large investors can to some extent demand and receive more than just financial statements. Under the Securities Act of 1934, corporations whose shares are registered are required to file with the SEC an annual report form, 10K, which requires disclosure of specific information from financial statements to a physical and geographic description of certain properties. If a specific type of event occurs between reporting periods, the firm is also required to submit a special report.\(^6\) Certain creditors may require special information before loaning funds.

Two of the users are concerned with reporting the information provided in financial statements. Trade associations and the financial press are concerned with reporting and aggregating information. The government also uses information contained in financial statements. Net national product is determined by subtracting total depreciation deductions claimed on tax returns from gross national product. Other groups are hired by


\(^6\)These reports filed with the SEC are available to the public.
users to interpret specific information in the statements. Lawyers, for example, are hired to assist in determining compliance of firms to governmental and contractual agreements with creditors.

Those users remaining, owners (investors), employees and customers, generally make decisions based upon financial accounting and other publicly available information. This includes the group that the Trueblood Committee felt should receive primary consideration in setting accounting policy. This group is users who have limited authority, ability or resources to obtain information and who rely on financial statements as their principal source of information about an enterprise's economic activities.7

The emphasis on present and potential investors has also been expressed by the FASB.8

Information Requirements for Different Investors: An Examination

In order to examine the effects of information on these individuals an information evaluation approach based on decision theory and information economics will be used to consider the relative benefits of information to investors.9 This approach has been used particularly

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7 Accounting Objectives Study Group, Objectives, p. 17.
8 Financial Accounting Standards Board, Materiality.
in managerial accounting. It allows one to focus on the accountant as a decision maker and call for him to identify the information alternatives, evaluate them in terms of some specified set of objectives, recognize and deal with the presence of uncertainty and choose the most desirable information alternative... The information evaluation method is a cost benefit method that basically entails having the accountant predict the relationships among the cost system, the decision maker's choice process, and the results.

This approach is consistent with the assumption that decision making involves determining alternative actions, considering effects of these actions and assigning values to them. Information evaluation considers the value of accounting information as an ex ante concept.

Two other approaches which have been suggested for financial accounting provide an ex post evaluation. The predictive ability criterion has been suggested as a method of evaluating information. Studies using this criterion have attempted to determine which income method best predicts its own future values. However there is no guarantee that the method


will be the best in the future or that individuals will necessarily use
the same prediction methods. If the efficient market hypothesis is accep-
ted then Beaver concludes

Subject to a more complete analysis...the finding pro-
vides a prima facie evidence that the method which is
more highly impounded [associated with security prices] 
ought to be the method reported in the financial state-
ments.  

However this is also an ex post concept.

In order to examine the effects of information on users, some rather
restrictive assumptions will be introduced and then relaxed. The four
facets of each individual's decision model that will be considered are:

1. the available resource commitments that can be under-
taken
2. the possible future states of the environment that 
can occur
3. the return associated with a certain resource commit-
tment if a certain future state occurs
4. the probabilities of the future states occurring.

These facets are developed by an individual based upon his experience.

Decision makers are assumed to select among alternative resource commit-
ments to maximize the net expected value of the future benefits. Further-
more the net benefits are assumed to be determined by subtracting the 

costs from the benefits determined without any cost considerations.  

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14William H. Beaver, "The Behavior of Security Prices and Its Impli-
cations for Accounting Research (Methods)," The Accounting Review, Supple-
ment to Vol. SLVII, 1972, p. 428.

15Demski, Information Analysis, p. 4. Accounting literature tends
to assume that people are neutral toward risk hence the maximization of
expected monetary return is appropriate. Decision theory considers the
maximization of expected value one possible choice method.
The Use of Financial Accounting Information by Different Investors: An Analysis

Since the beginning of the nineteenth century underlying much of the discussion about accounting policy has been the belief that reported earnings affect investor behavior. Furthermore the Trueblood Committee felt that certain users typically rely only on financial statements to make decisions. Comments by investors and creditors tend to support the importance of financial statements in decision making. Several studies have suggested that financial statements appear to be a significant source of information for investment decisions. Consequently the information source that will be considered in this situation is from a financial accounting system.

References:

17 Accounting Objectives Study Committee, Objectives, p. 17.
Table 5 Notation for Problem Situations

$I_i$ = the $i^{th}$ user ($i = 1, \ldots, N$)

$X_j$ = the alternate actions ($j = 1, \ldots, b_i$) that $I_i$ can take

$n_k$ = the information systems ($k = 1, \ldots, c_i$) that $I_i$ can use

$y_{p/k}$ = the signal ($p = 1, \ldots, d$) that can be generated by $n_k$

$S_{i'}$ = the possible states ($i = 1, \ldots, e_i$) that $I_i$ believes

might occur

$P_i(S_L)$ = $I_i$'s estimation of the probability that $S_L$ will occur

$Z_i(X_j, S_L)$ = the payoff to $I_i$ if action $X_j$ is taken and state $S_L$ occurs

In the first situation the market will be assumed to consist of two investors, $I_1$ and $I_2$, who face decisions about revising their investments in two securities, $X_1$ and $X_2$. Both individuals have the same partitions of future states, returns and acts. Consistent with the accounting literature, the future payoffs will be stated as future cash consequences. $I_1$ owns all shares of $X_1$ and $I_2$ owns all shares of $X_2$. These relative holdings are the result of the individuals' past experiences. Table 6 provides a summary of the facets of the decision models for this situation. Action $X_1$ may be considered as buying (or holding) all available shares of $X_1$ while Action $X_2$ buying (or holding) all available shares of $X_2$. Before new information is received each individual is holding shares consistent with his maximization of expected benefit. Now let there be only one information system, the financial accounting one based upon historical cost. Let the signals be interpreted the same way by each individual at

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20 Financial Accounting Standards Board, Materiality, p. 93.
21 This assumption is consistent with the personalistic view of probabilities, Savage, Foundations, p. 3 and research on perception, Caplan, Management, pp. 52-55.
Table 6 Facets of the Decision Model for Situation 1

<table>
<thead>
<tr>
<th>Facets</th>
<th>Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actions</strong></td>
<td>I₁, X₁, X₂</td>
</tr>
<tr>
<td><strong>States</strong></td>
<td>S₁, S₂</td>
</tr>
<tr>
<td><strong>Probabilities</strong></td>
<td>P₁(S₁) = .2</td>
</tr>
<tr>
<td></td>
<td>P₁(S₂) = .8</td>
</tr>
<tr>
<td><strong>Payoff</strong></td>
<td>Z₁(S₁,X₁) = 0</td>
</tr>
<tr>
<td></td>
<td>Z₁(S₁,X₂) = 12</td>
</tr>
<tr>
<td></td>
<td>Z(S₂,X₁) = 20</td>
</tr>
<tr>
<td></td>
<td>Z(S₂,X₂) = 12</td>
</tr>
</tbody>
</table>

no cost. Let y₁/n₁ be the signals received such that

\[ P(y₁/S₁) = .2 \quad \quad \quad \quad \quad \quad \quad P(y₁/S₂) = .7 \]
\[ P(y₂/S₁) = .8 \quad \quad \quad \quad \quad \quad P(y₂/S₂) = .3 \]

and signal y₁ is received. Bayes theorem will be used to represent the method by which individuals process the information (Table 7).
Table 7 Value of Information-Situation 1

<table>
<thead>
<tr>
<th></th>
<th>Individual</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I₁</td>
<td></td>
<td>I₂</td>
</tr>
<tr>
<td>Before</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>E(Z/S₁) = (.2)(0) + (.8)(20) = 16*</td>
<td>E(Z/S₁) = (.5)(0) + (.5)(20) = 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E(Z/S₂) = (.2)(12) + (.8)(12) = 12</td>
<td>E(Z/S₂) = (.5)(12) + (.5)(12) = 12*</td>
<td></td>
</tr>
<tr>
<td>* Action Selected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receipt of Information</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State</td>
<td>S₁</td>
<td>S₂</td>
<td>S₁</td>
</tr>
<tr>
<td>P(S₁)</td>
<td>.2</td>
<td>.8</td>
<td>.5</td>
</tr>
<tr>
<td>P(y₁/S₁)</td>
<td>.2</td>
<td>.7</td>
<td>.2</td>
</tr>
<tr>
<td>P(y₁/S₁)P(S₁)</td>
<td>.04</td>
<td>.56</td>
<td>.10</td>
</tr>
<tr>
<td>P(S₁/y₁)</td>
<td>.067</td>
<td>.933</td>
<td>.222</td>
</tr>
<tr>
<td>After</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>E(Z/A₁) = (.067)(0) + (.933)(20) = 18.66*</td>
<td>E(Z/A₁) = (.222)(0) + (.778)(20) = 15.56*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E(Z/A₂) = (.067)(12) + (.933)(12) = 12</td>
<td>E(Z/A₂) = (.222)(12) + (.778)(12) = 12</td>
<td></td>
</tr>
<tr>
<td>Expected Value of Information</td>
<td>2.66</td>
<td>3.56</td>
<td></td>
</tr>
</tbody>
</table>

In this case, the expectation of the receipt of a particular signal from the given information system will result in different expected benefits. Therefore the expected value of information, defined as the difference in expected benefits before and after the receipt of information, is different. The expected benefit for I₂ from the receipt of signal y₁ is .9 greater than that of I₁. However, in order for I₂ to realize this
increased expected value, he must change his holdings. In this case $I_1$ already owns all shares of $X_1$ and after receipt of signal $y_1$ will continue to hold $X_1$. Therefore $I_2$ will be unable to implement action $X_1$.

The Use of Financial Accounting Information by Investors: A Further Analysis

Currently financial statements present signals that are based on historical cost. The individual must transform these signals into a probability distribution on the future states. There is no guarantee that the same signals will be interpreted with the same probabilities by each individual.

The examination of the effect of signals from accounting systems using different accounting policy alternatives on specific users has just recently been undertaken. Five laboratory experiments tend to show conflicting results. Hofstedt asked executives and MBA students to predict future earnings based upon consistent financial accounting policy alternatives. He concluded that the financial statements were important sources of information. The individuals did not differ significantly in terms of their predictions but did differ in the time spent processing the signals. Since these individuals had not translated their earnings expectations into predictions about future returns and there are processing differences, the experiment can be considered to support the hypothesis

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of individual differences in information processing. \cite{Dopuch73} Dopuch and Ronen found that in a laboratory setting decisions could be altered by using different accounting alternatives. \cite{Dopuch73}

In another laboratory experiment, Pankoff and Virgil found that analysts when offered a variety of information tended to select certain ones more frequently. With this information, the analysts' prediction of stock price differed significantly from students who were not provided any information. \cite{Pankoff70} In another experiment, McIntyre asked individuals to select among four firms in the same industry for investment purposes. The individuals were provided with signals from different financial accounting information sources. He found no significant differences in the decisions made by the individuals. \cite{McIntyre73} Finally Heintz found in a laboratory experiment that in 9 of 10 periods that students using signals from different financial accounting information sources did not make significantly different predictions about the stock price of three firms. \cite{Heintz73}

\begin{itemize}
\item \cite{Dopuch73} N. Dopuch and J. Ronen, "The Effects of Alternative Inventory Valuation Methods - An Experimental Study," \textit{Journal of Accounting Research}, Autumn, 1973, pp. 191-211.
\end{itemize}
Considering that an individual's probability encoding of the signals is based upon his past experience, there is no reason to necessarily believe that they will be the same for any two individuals. Indeed the discussion of sophisticated and unsophisticated investors is concerned with the abilities of one group to process information differently from others. The next situation considers the case where the individuals have different processing capabilities, (Table 8). I₂ is assumed to be unable to discriminate as well as I₁ about the probabilities of future states given a signal. Assume that y₁/n₁ is received.

Table 8 Value of Information for Situation 2

<table>
<thead>
<tr>
<th>Probabilities of Signals For a Given State</th>
<th>I₁</th>
<th>Individual</th>
<th>I₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(y₁/S₁) = .2</td>
<td>P(y₁/S₂) = .7</td>
<td>P(y₁/S₁) = .2</td>
<td>P(y₁/S₁) = .3</td>
</tr>
<tr>
<td>P(y₂/S₁) = .8</td>
<td>P(y₂/S₂) = .3</td>
<td>P(y₂/S₁) = .8</td>
<td>P(y₂/S₂) = .7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Receipt of Information</th>
<th>State</th>
<th>S₁</th>
<th>S₂</th>
<th>State</th>
<th>S₁</th>
<th>S₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>P(S₁)</td>
<td>.2</td>
<td>.8</td>
<td></td>
<td>P(S₁)</td>
<td>.5</td>
<td>.5</td>
</tr>
<tr>
<td>P(y₁/S₁) = .2</td>
<td>.2</td>
<td>.7</td>
<td></td>
<td>P(y₁/S₁) = .2</td>
<td>.2</td>
<td>.3</td>
</tr>
<tr>
<td>P(y₁/S₁) = .04</td>
<td>.067</td>
<td>.933</td>
<td></td>
<td>P(y₁/S₁) = .10</td>
<td>.40</td>
<td>.60</td>
</tr>
</tbody>
</table>

| After                  | E(Z/A₁) = (.067)(0) + (.933)(20) = 18.66* | E(Z/A₁) = (.4)(0) + (.6)(20) = 12* |
|                        | E(Z/A₂) = (.067)(12) + (.933)(12) = 12 | E(Z/A₂) = (.4)(12) + (.6)(12) = 12* |

| Expected Value of Information | 2.66 | 0 |

---

Before considering costs, there are no benefits to $I_2$. If the costs to $I_1$ are less than 2.66, there are positive benefits to $I_1$ and negative ones to $I_2$.

The assumptions of only a single information source being available is very restrictive. Several of the indirect users provide information to direct users. If an individual considers the states to be representations of the economy, information on general economic and industry conditions may be important. Furthermore certain users rely on others to make investment decisions. For example an investor may hire someone to manage his investments.

A recent survey in one metropolitan area found that financial statements were not considered as the most important investment source for investors.\(^2\) \(\text{Table 9}\)

<table>
<thead>
<tr>
<th>Information Sources</th>
<th>Percentage of Investors who Rated Source Most Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock Brokers</td>
<td>46.8</td>
</tr>
<tr>
<td>Advisory Services</td>
<td>15.6</td>
</tr>
<tr>
<td>Newspapers</td>
<td>11.3</td>
</tr>
<tr>
<td>Friends</td>
<td>9.7</td>
</tr>
<tr>
<td>Financial Statements</td>
<td>7.9</td>
</tr>
<tr>
<td>Magazines</td>
<td>3.5</td>
</tr>
<tr>
<td>Tips</td>
<td>.4</td>
</tr>
<tr>
<td>Others</td>
<td>4.8</td>
</tr>
</tbody>
</table>

More research has been conducted on the information sources used by security analysts. In addition to financial statements, other sources used

include publications, competitors, interviews and comments in annual reports. 30 Recently the FASB conducted interviews with "selected knowledgeable users" of financial statements. Some of the results of the interviews are shown in Table 10. 31

Table 10 Selected Information Needs of Certain Investors

<table>
<thead>
<tr>
<th>Long Term Investor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservatism of Accounting System</td>
</tr>
<tr>
<td>Analysis of Earnings</td>
</tr>
<tr>
<td>Historical Data, Trends Rations</td>
</tr>
<tr>
<td>Earnings Projections</td>
</tr>
<tr>
<td>Trends</td>
</tr>
<tr>
<td>Consumer Spending, Demography, Interest Rates</td>
</tr>
<tr>
<td>Regulatory and Political</td>
</tr>
<tr>
<td>Industry Trends</td>
</tr>
<tr>
<td>Demand, Volume and Cost</td>
</tr>
<tr>
<td>Management Depth, Development</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Short Term Investor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Earnings</td>
</tr>
<tr>
<td>Impact of an Accounting Change</td>
</tr>
<tr>
<td>Earnings Projections</td>
</tr>
<tr>
<td>Regulatory and Political Events</td>
</tr>
<tr>
<td>Current Production Demand</td>
</tr>
</tbody>
</table>

Some of these information needs cannot be met by financial statements. Studies, however, do show that financial statements are used by analysts. 32

All individuals cannot be assumed to use the same information systems. An individual may not use certain information systems because of his lack of access to or his lack of knowledge about the system. Some information systems may be unavailable during an individual's decision horizon. Furthermore, since there are alternative systems available, an individual

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30 Mautz, Financial Reporting.
may not use a particular system because it does not have as high an ex ante value as others. With other systems available, \( I_2 \) in the previous situation would not use the information system because he perceives no benefits.

**Expanding the Use of Financial Accounting Information**

The previous situations have assumed a complete model in which the effect of information is to revise the probability distribution of future states. However this assumption requires a specification of the decision model that is too costly to accomplish.\(^{33}\) There are a large number of alternative actions which are typically available to an investor. Information may be used to screen securities which an investor will consider further. A signal may alert an investor to a new alternative or remove some from consideration.

The receipt of a signal may cause \( I_1 \) to revise the states he considers relevant. For example predictions about the economy may cause \( I_1 \) to consider the possibility that one state could be a severe recession. By relaxing the assumption of homogenous partition of states, all users will not necessarily consider the same partition of states. One investor may consider the states to be the possible future states of the economy while another the possible future value of the shares. A creditor may partition his states by considering default on the part of the company. An information system which indicates that an investor should change his states into different share prices, may have no benefit to a creditor. Finally information may change the expected payoffs from selecting a given action and

\(^{33}\)Demski, *Information Analysis.*
the occurrence of a future state. These effects on an individual's decision model are summarized in Figure 4. The relaxation of the assumptions of the two situations considered leads to a model in which it is extremely difficult to determine the ex ante benefits of signals from different information sources.

\[
\begin{align*}
\text{Figure 4} & \quad \text{Possible Effects of Information on Facets of the Decision Model} \\
\text{Summary} & \quad \text{Individuals do make decisions regarding information systems to be used. Certain systems are provided only at certain explicit costs to}
\end{align*}
\]
individuals. For example, investment advisory services are available to investors. For one group, creditors, a form of investment advisory services, bond ratings are widely used. Other information is provided to individuals at no cost. Industry and general economic data are provided in some cases free. However an individual faces processing costs to interpret these signals.

Given the situations discussed previously, there is no reason to believe that individuals have the same expectation about information systems. Adding the possibility of information revising his actions, possible states and payoffs greatly increases the likelihood that individuals do not have the same expectations about signals. The addition of processing costs might cause the expectations to converge because an individual who has high gross benefits, $I_1$ in the second situation, might have high processing costs. However accounting feels that sophisticated investors would have higher gross benefits and lower costs than unsophisticated investors.

An FASB discussion memorandum recently stated that "to the extent the needs of professional users are met, the needs of other primary users will also be met." 34 Unless everyone had the same decision model using the same partition of the facets interpreting the signals in the same way with the same processing costs there is no guarantee that meeting the information needs of one group will meet the information needs of another. 35 The statement is also suspect because of the type of market in which

34 Financial Accounting Standards Board, Materiality, p. 90.
35 A laboratory experiment casts doubt on individuals with the same training in accounting using the same facets of a decision model. See Dopuch and Ronen, "Effects," p. 203.
investors operate. In situation 1, $I_2$'s optimal action has changed. $I_2$ may be unable to implement the purchase of $X_1$ because the shares are already owned by another. Superior time processing capabilities may put an individual into a better position. Therefore providing information preferred by one group may place another at a distinct disadvantage.

Section II

Suppliers of Financial Accounting Information

In Section I, the net benefits of information to an individual were determined by including the costs of processing with the benefits obtained from the information. As noted certain information is supplied to users at no cost. Users face only the costs necessary to process the information. If users believe that the costs of processing are greater than the benefits obtained, they can simply avoid processing the information.

In this section, the environment of suppliers will be examined. The preferences of one particular group of suppliers, firms, will be discussed. In some cases those who supply information at no cost are in a position to stop supplying at will with no sanctions placed on them by other private or governmental agencies. Industry and trade associations which supply economic information as a by-product of other activities could cease publication of the information. In fact the information reported by industry and trade organizations is typically used as support for activities they are undertaking or would like to undertake. Those who supply information from financial accounting systems are unable to stop supplying the information without sanctions. The requirements of reporting financial accounting information are determined by the policy making bodies.
Firms' Objections to Supplying Additional Accounting Information

Firms are reluctant to supply additional accounting information to users. Several reasons have been cited for this reluctance. Among the objections to supplying additional information are these possibilities:

1. of releasing additional information to competitors
2. of increased costs
3. of changes in the tax law
4. of objection by the auditors
5. that investors are "better able to judge the performance of management."

The first objection is questionable given the previous comments that certain investors use information received from a firm's competitors. Certain amounts of information are provided competitors through trade associations. Other activities including industrial espionage are used to gain information about competitors. Furthermore, if additional information is required, a firm can also receive the additional information about competitors. Notwithstanding these arguments, management has a psychological fear of supplying additional information.

The costs of preparing financial statements are borne exclusively by the particular firm. The firm is responsible for providing the necessary bookkeeping system to record transactions. It summarizes the data and prepares the financial statements. The firm hires a public accountant to audit the financial statements. It also secures necessary counsel to aid

in any filings with regulatory agencies or stock exchanges. Therefore when asked to supply any additional information the cost to the firm is typically non zero.

The purpose of the tax law is to provide revenue for the government and to provide a means of encouraging certain activities. The goal of financial accounting is so different from the purpose of the tax law that financial accounting should have little impact on the tax law. The fact that firms tend to keep "two sets of books" is an indication of this difference. However in 1971, the Internal Revenue Service did announce that it was going to study possible requirements for a closer relationship between the tax law and financial accounting. To date, the Internal Revenue Service has made no additional comments about this subject.

Since the discussion is concerned with new accounting policies, the objection by auditors appears questionable. If new information to be reported is required by the policy making bodies, the auditor would not object because he would be following accounting policies. New information requirements, however, may increase the time and skills needed to complete the audit and hence the cost of the audit.

The final objection is suspect because of a lack of meaning for "better able to judge." In an environment characterized by a lack of certainty, additional information may not allow an individual to better judge a firm. Furthermore if a firm was doing "well," management might desire to provide additional information to indicate this situation. Management, however, may not want to be evaluated on the results of specific decisions but on their overall results. Therefore management may oppose supplying additional information.

Benefits and Costs in Supplying Additional Accounting Information
These five objections can be summarized in a single objection to supplying additional information. A firm's reluctance to provide additional information is based upon the aggregate benefits received from supplying additional information by that firm being less than the aggregate costs incurred from supplying the information. For the analysis of this section, new information will be divided into two types:

1. additional information provided from accounting systems using historical cost valuation.

2. additional information provided from accounting systems using alternative valuation procedures.

The distinction is similar to the one made by the SEC between disclosure and measurement in accounting policy making. For ease additional information provided from accounting systems using historical cost valuation will be referred to as additional disclosure; additional information provided from accounting systems using new valuation procedures will be referred to as additional measurement information.

The distinction between these two types of additional accounting information is based upon management's usage of this additional information. Whether historical cost accounting information is useful in management decisions is questionable. The Committee on Foundations of Accounting Measurement felt that a fundamental difference exists between the structure and data requirements of managerial decision models and financial accounting. In planning decisions, management desires information regarding future revenues and costs. "Historical costs may be the basis

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of predicting expected future costs but the latter are the necessary inputs to the relevant costs and decision models.\textsuperscript{39}

In the 1960's the accounting literature contained considerable discussion about the importance of financial accounting information in managerial decisions. In separate laboratory experiments, Dyckman and Bruns found that the method of inventory valuation had little effect on management decisions.\textsuperscript{40} In another laboratory experiment, Bruns found that changing the reporting period for financial statements did not appear to affect decisions. Furthermore the subjects tended to report a greater use of nonfinancial accounting information in making decisions.\textsuperscript{41} These results are consistent with Khemakhem's findings that in the short-run management typically maximizes "funds" not earnings.\textsuperscript{42} However in another simulation study, Bonini found that the method of inventory valuation did affect decision.\textsuperscript{43} Ijiri, Jaedicke and Knight suggest that accounting does affect management decisions in an ill-structured environment where accounting supplies the managers' goals.\textsuperscript{44} In later laboratory experiments

\textsuperscript{39}Committee on Managerial Decision Models, "Report of the Committee on Managerial Decision Models," The Accounting Review, Supplement to Volume XLIV, 1969, p. 47.
Mock found that subjects provided with traditional accounting variance analysis did better than those who did not receive this additional accounting information. In separate analyses, Culpepper and Dyckman conclude that accounting information influences decisions but there is a need to further investigate exactly how accounting information affects decisions.

Additional disclosure requirements will have questionable benefit to management. The requirement of additional measurement information will benefit management only if the information can be used for management decisions. Dermer believes that determining the value of information may be difficult because

if the effects of variations in accounting variables are to be isolated, care must be taken to avoid confusing these with the effects of individual differences.

However, the costs of providing additional measurement information, particularly to external users, are substantial.

The benefits to the firm of supplying information to users are uncertain. In one situation, a firm could provide less than the minimum required by the policy making bodies and is consequently subject to the costs of disregarding the policy. The firm would be subject to

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disciplinary action which would lead to a minimum, bad publicity, and to a maximum, a fine and suspension of trading in its shares. In another situation, a firm would supply more information than the policy making bodies require. The reaction of the users will determine the benefits to the firm. For example, investor reaction may allow the firm to sell a new common stock offering with greater ease. By supplying additional information investor discontent might be reduced, so the firm might have to spend less time dealing with unhappy shareholders. By providing this additional information, the firm may face a cost of justifying the methods used in supplying the information to the policy making bodies. For example, the SEC recently indicated that firms making public forecasts may be required to file with the SEC the forecast and other relevant information.

Summary

The costs and benefits to the firms of supplying information to users are summarized in Table 11.

Table 11 Costs and Benefits to the firm supplying certain amounts of Information

<table>
<thead>
<tr>
<th>Firm's</th>
<th>Information Supplied in Relation to Requirements Set by Policy Making Bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Below</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal Benefits</td>
<td>Uncertain</td>
</tr>
<tr>
<td>External Benefits</td>
<td>Low</td>
</tr>
<tr>
<td>Costs</td>
<td>High</td>
</tr>
</tbody>
</table>
In light of the costs and benefits to the firm of providing information to users outside the firm, the decision which maximizes the net benefits (or minimizes the costs) is one which provides only that level of information required by the accounting policy making bodies. Furthermore, a firm should oppose any attempts to increase the minimum information requirements set by accounting policy making bodies.

Section III

**Differences Between Suppliers and Users**

In Section I, users of financial accounting information were discussed. Although other sources of information are available, financial accounting systems appear to be an important information source. Furthermore empirical evidence indicates that certain users want additional information disclosed from current accounting systems; others want changes in the measurement system itself. There is also the reluctance on the part of firms to supply additional accounting information. (Section II).

In a survey, Asebrook and Carmichael found that financial analysts desired forecast income statements more frequently than did executives.\(^\text{49}\) Previously Estes found a strong interest among financial analysts and bank loan officers for replacement cost accounting. Executives were found less interested in replacement cost accounting.\(^\text{50}\) In an extension of the Estes study, however, Brenner found that most of the users

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surveyed wanted earnings per share based upon both historical cost and current value accounting. 51

The Effect of Users Information Requests on Suppliers

The situation in which financial accounting operates is unique. The firms supply financial accounting information without charging users based upon the quantity of information supplied. The only ways that users can obtain additional accounting information are directly from the firms or by requesting the policy making bodies to require the firms to supply the additional information. Relating the benefits received and the costs incurred, firms usually will not provide the additional information on a voluntary basis. This means most users' demands for additional information are presented to the FASB and SEC. Such bodies must set policies without any price mechanisms being available to equate supply and demand for accounting information.

Methods for Users to Obtain Additional Information

Given the diverse nature of different users, two forms of compensation are possible for certain users to get additional information. In the first case, users who desire additional information can pay to get the support of those users who do not desire the additional information. For example, \( I_1 \) perceives a large positive expected value of information for some information not currently supplied. \( I_2 \) perceives no change in his expected value from receiving this same additional information. In order to secure \( I_2 \)'s support for requiring the additional information, \( I_1 \) can pay \( I_2 \) an amount less than his increase in expected value. Both

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I₁ and I₂ will be better off by having the policy making bodies require that firms supply this additional information.

In the second case, users who desire additional information can pay the firms directly to supply the information. For example, I₁ perceives a large positive expected value of information for some information not currently supplied. I₁ can pay the firm to supply the information. I₁ would have to pay at least the costs incurred by the firm in supplying the information. The costs of the firm supplying the information may be greater than the benefits received by I₁. The payments that I₁ would have to make in this case appear higher than those required in the first case. So this case appears to be a less desirable method for I₁ to get additional information. However, both of these methods of obtaining additional information are unacceptable for accounting policy making. 52

The Role of the FASB and SEC

The FASB and SEC must equate the supply and demand for financial accounting information in a setting that has mostly evolved during the last forty years. Since the current situation involves a tradeoff between different suppliers and users (Figure 5), a method for selecting policy alternatives is necessary. The next section considers possible methods available to accounting policy making bodies.

52 For example see, "'Inside' Information Rules Cover Analysts As Well As Companies," The Wall Street Journal, October 3, 1972, p. 2.
Figure 5 The Environment of Accounting Policy Making Bodies
Section IV

Social Choice Alternatives

Since the FASB is required to make decisions which may affect users and suppliers differently, a social choice method to make these decisions is required. Arrow suggests four types of social choice methods which have been used through history. They are tradition, the market mechanism, imposition and voting. Arrow notes that "in a capitalist democracy there are essentially two methods by which social choices can be made: voting ...and the market mechanism."\(^5\) Demski suggests that all of these except tradition have been used to determine accounting policy.\(^4\) In this section, the four methods will be reviewed and a fifth method which can be considered a combination of imposition and voting will be presented.

Tradition

Tradition tends to be used by organizations with long histories and facing a relatively stable environment. The accounting profession in the United States is relatively recent.\(^5\) The changing nature of the financial environment makes the use of tradition suspect. For example, one of the reasons for the issuance of APB Opinion No. 16 on business combinations, which helped to bring the downfall of the APB, was the conglomerate movement of the 1960's. An examination of financial statements of the early part of the twentieth century show significant changes. The financial statements of United States Steel (1903) and Eastman Kodak

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\(^5\)Carey, Rise, dates the accounting profession from 1896.
(1902), the first issued by these companies, present only balance sheets. The evolutionary process of accounting policy making has been recognized.

Present generally accepted accounting principles are the result of an evolutionary process that can be expected to continue. Principles change in response to changes in economic and social conditions, to new knowledge and technology, and to demands by users for more serviceable financial information.56

In order to use tradition to determine accounting policy an appeal to authority is necessary. The environment of the FASB makes the policy making body unable to rest solely on its authority.

The Market Mechanism

The ability to use a market mechanism is suspect considering the history of accounting policy making. Until 1933, there was very little governmental regulation of the securities markets and financial information. Indeed the purpose of the securities acts was stated as:

For the reasons hereinafter enumerated, transactions in securities as commonly conducted...are affected with a national public interest which makes it necessary to provide for regulation and control of such transactions and of practices and matters related thereto, including ...to require appropriate reports, and to impose requirements necessary to make such regulation and control reasonably complete and effective...57

Included in the acts was the right of the SEC to set the format of and the accounting policy alternatives to be used in financial statements. At the time of the enactment of the securities acts, a general consensus appears to have been that allowing the market for financial information

57Section II Securities Exchange Act of 1934.
to function without control was unacceptable. At least one researcher, Benston, has indicated that the number of questionable practices before the securities acts was rather small.

Thus the need for financial disclosure requirements appear to have had their genesis in the general folklore of the turn-of-the-century finance rather than the events of the 1920's...58

In response Backer points out that from the basis of much of Benston's work it would be extremely difficult to determine the actual number of questionable practices because of his examination of legal proceeding.59

The SEC does not favor individuals receiving information above that publicly available. If one considers the obtaining of inside information as an example of the market mechanism, then the SEC is currently opposed to such methods.

Imposition

Demski suggests that two forms of imposition, dictatorial and convention, have been used to set accounting policy. Tradition will be considered equivalent to convention. He cites as examples of dictatorial imposition "Congress and the various governmental agencies that affect financial reporting, as well as the FASB."60 In this environment the ability to set accounting policy in the private sector by imposition without substantial support from those interested in financial accounting

information is extremely difficult. One of the changes that has occurred since the 1930's is the increased interest of those outside the accounting profession in accounting policy making. This had led to a situation in which

No longer should it be possible to legislate accounting standards by fiat; no longer should it be possible to thunder "Thou Shalt" without continuing with "Because."

Even with imposition, the method of determining the policies must be considered. Four methods of determining the policies to be imposed are possible:

1. on the basis of what the body believes is good for itself
2. on the basis of what the body believes is good for the accounting profession
3. on the basis of what the body believes is good for interested individuals without examining any empirical evidence on preferences from these individuals
4. on the basis of what the body believes interested individuals desire using empirical evidence on preferences from these individuals.

The emphasis in recent accounting literature on users makes the first two methods suspect. Many believe there are differences in the goals of the SEC and the accounting profession.

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The fundamental goal of the Commission [SEC], which is a fair and efficient capital market and the fundamental goal of the accounting profession, which is the existence of a prosperous and respected group of professional practitioners of accounting are generally consistent.  

To impose accounting policies without actively considering users and suppliers will lead to strong objections to those policies. Therefore considering these suppliers and users is necessary. However a question remains as to how this is to be accomplished.

**Voting**

A social choice method that can be used to indicate the preferences of interested individuals is voting. It has been considered on a limited scale in setting accounting policy. The policy making bodies have determined accounting policies on the basis of voting by its members on policy alternatives.

Voting by all interested individuals could be on two levels: 1) to select candidates as representatives to a body that decides accounting policies or 2) to select accounting policies from particular alternatives. Those who have discussed the use of voting in accounting have for the most part considered the latter approach. Objections to voting on accounting policy alternatives are varied. Some feel special expertise is necessary to determine accounting policy decisions. Mautz asks and negatively answers the question "Would anyone seriously recommend a popular vote on such a technical method of calculating earnings per share..."  

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64 Mautz, "The Other," p. 60.
In addition there are questions regarding who will vote, on what issues they will vote, how their votes will count and how often will they vote. The costs of voting may make it impossible to accomplish voting on policy alternatives. Three further objections to voting have been voiced: 1) sometimes inconsistent results are obtained, 2) failure to consider the intensities of individual preferences and 3) individuals may misrepresent their true preferences. Each of these three objections will be considered.

The first objection is based on the Arrow Impossibility Theorem. When there are a number of alternatives which individuals are free and able to order for all alternatives and such relationships determined by the individuals are transitive, the Arrow Impossibility Theorem states that there is no social welfare function which requires the positive association of social and individual values and the independence of irrelevant alternatives. The Theorem cannot be avoided by the policy making body setting objectives for accounting and then deciding among policy alternatives on the basis of objectives. Demski has shown that

No set of standards exists that will always rank alternatives in accordance with preferences and beliefs... as long as they are consistent in admitting to expected utility characterization.

Objections have been raised to the assumptions of the Arrow Theorem for individuals. It has been suggested that individuals exhibit

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intransitive rankings. In attitude measurement theory and political science, the actual rankings among alternatives exhibited by individuals have been found to be considerably less than the statistically possible rankings. Luce and Raiffa suggested that the assumption of the independence of irrelevant alternatives is questionable. In accounting, one would have to wonder what is an irrelevant policy alternative. After examining the paradox, Riker and Ordeshook conclude

...we are not deeply disturbed by the paradox, for it serves mainly to remind us that society is not the same as the people who compose it. People are not invariably disturbed by the inconsistencies...of market outcomes... Markets have been churning out such inconsistencies for centuries without leading us to reject them as useful tools. Similarly there is no reason to reject other institutions of summation simply because they also are incoherent by human (i.e., individual) standards.

In situations outside of accounting rules tend to be developed to restrict one of the requirements of the theorem in order to avoid its conclusion. The two party system and the rules of the U. S. Congress tend to prevent the situation described in the theorem from occurring by reducing the number of alternatives being considered. Therefore, accounting might select a procedure to screen the alternatives in order to reduce the possibility that the situation described in the theorem occurs. An organization formed to accomplish this task would face problems similar

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to those of the FASB.

The second objection, precluding taking into account intensities of preferences, is interesting considering current economic theory.

Most economists today, however, are more than somewhat skeptical about the usefulness of social welfare function based on interpersonal comparisons of utility because of the theoretical and practical difficulties associated with measurement of intensity of preference.\(^\text{72}\)

In economic theory, equivalent results are derived from different assumptions regarding the interpersonal comparison of preferences. Therefore the weaker assumption of no interpersonal comparison of preferences is considered more desirable.\(^\text{73}\) The ability to take into account the intensities of individuals' preferences would depend on the situation in which the comparisons were being made. For example, the same individual making comparisons about two other individuals' preferences might be more acceptable than two individuals being compared directly.

In order for the final objection to be valid, one individual or group of individuals must have perfect knowledge about the preferences of others. For a voting situation involving large numbers of individuals, to have an effect on the outcome would require a large group of individuals conspiring together. To accomplish this without outsiders discovering the plan would seem to be extremely doubtful.

The seriousness of these three objections would depend on the


circumstances involved. The previous objections to voting for alternatives appear to be more important. Basically the same objections also hold for voting for representatives to set accounting policy. There is the problem of insuring that those elected will have the special expertise required to make these decisions. In addition there are questions regarding who will vote, on what candidates they will vote, how their votes will count and how often elections will be held. In light of these objections another alternative will be proposed.

**Spatial Analysis**

Another alternative method is to have the policy making body take into account individual preferences for information when determining accounting policy. Spatial analysis, from political science, can be used to examine policy alternatives. For purposes of introduction, spatial analysis can be considered a variant of location theory. In industrial engineering, location theory is used to solve physical distribution problems. It can be used to determine the location of a distribution center to minimize costs given the location of a number of stores with different supply requirements. Theoretically there is no reason that the application of location theory should be restricted to a physical space. Euclidean spaces are used for much of the analysis of general equilibrium theory.74

One of the original purposes of spatial analysis was the examination of candidate positions on related issues to insure a winner.75 Others extended the analysis to consider the best position on a number of issues

74Quirk and Saposnik, *Introduction*, p. 3.
for a certain type of dictator and committee chairman.\textsuperscript{76} In order to accomplish the analysis, certain assumptions are typically made for election situations to enable its use. These assumptions relate to the issue space, the representation of individuals and candidates' objectives.

**Issue Space**

Most public policy decisions are concerned with several different issues, some of which are interrelated. For example, the decision to commit resources for capital improvement projects which are expected to provide future benefits typically involves a number of different issues. For example what projects are going to be undertaken and how they are going to be financed must be determined jointly. In psychology it has been stated

\begin{quote}
Most significant decisions involve choosing between courses of action whose probable consequences have multiple value relevant attributes... Rational decision making... requires that the decision maker trade off one value dimension against another in assessing the overall value of each possible outcome.\textsuperscript{77}
\end{quote}

The interrelationship of issues in an election has been noted.

\begin{quote}
Thus citizens' preferences cannot be ordered unambiguously on a single continuum, in which case spatial models must allow for more than one dimension of conflict and taste.\textsuperscript{78}
\end{quote}


\textsuperscript{78}Riker and Ordeshook, *Introduction*, p. 309.
The dimensions of the issue space may represent the policies considered by the electorate and qualitative aspects of the candidate. In another formulation, the dimensions represent only policies which can be represented on a real line and all others are included in the individual's judgment of the candidates.

**Representation of Individuals**

An individual is typically assumed to be represented by a preference function whose indifference contours imply a single most preferred point with symmetry and/or concavity. Individuals tend to vote for those who are closer to their preferred point called an ideal point. The Euclidean, City Block and Sup metrics can be considered as capable of generating isosimilarity contours for individuals. The metric\(^79\) used would depend on how an individual perceives his loss. If an individual perceives his loss as the normal distance between two alternatives, then his isosimilarity contours can be represented by a Euclidean metric. In Figure 6, let \(X_1\) be the ideal point for an individual whose perception of loss can be represented by a Euclidean metric. Policy alternatives A and B are equally preferred and are more preferred than alternative C.

![Figure 6 Preference Represented by a Euclidean Metric](image)

\(^79\)Appendix 1 presents a discussion of metrics.
In this application, an individual whose perception of loss is the sum of the differences on each issue can be described by a City Block metric. In a two dimensional issue space his contours would have a diamond shape. Using this might result in alternative B being preferred to A and C. (Figure 7).

![Figure 7 Preference Represented by a City Block Metric](image)

An individual who considers only the maximum distance on all issues in determining his loss can be represented by the Tchebycheff or Sup. metric. In a two dimensional space his indifference contours would have a square shape (Figure 8).

![Figure 8 Preference Represented by a Tchebycheff Metric](image)

These three metrics have assumed that the preference functions exhibit symmetry and concavity. By allowing unequal weightings on each issue,
the assumption of concavity of the preference function is relaxed. If an individual uses the Euclidean metric but weights Issue #2 twice as important as Issue #1 his indifference curve would appear as an ellipse (Figure 9). In this case alternative B is preferred to A and C.

![Figure 9 Preference Represented by a Euclidean Metric with Unequal Weightings](image)

**Candidates' Objectives**

The purpose of candidates has been suggested to win elections. For a certain type of election situation, a spatial analysis is conducted to determine if "a spatial position exists that at least ties and perhaps defeats all alternative spatial positions."\(^80\) A dictator might desire to minimize the loss of all individuals or minimize the maximum loss faced by individuals.\(^81\) He might, however, have a goal of keeping himself in power. Therefore he might desire to minimize the number of individuals whose losses are large enough to cause them to work to overthrow the current government.

**Summary**

The environment of the FASB makes it impossible to use the market

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mechanism, tradition or imposition by fiat as methods to set accounting policy. While voting might be possible, the problems associated with it make voting extremely difficult. Left is a method in which the FASB uses information obtained about individuals' preferences to set accounting policy. This is a form of imposition without decision making by fiat associated with it. Spatial analysis has been introduced as a method to allow the FASB to explicitly consider individual preferences. In the next section, the assumptions of spatial analysis are considered for accounting policy making situations.

Section V

Spatial Analysis and Accounting

Spatial analysis was originally used to consider voting situations. Accounting, however, has no procedure for allowing formal voting by all those interested in accounting policy. Indeed the committee, in which a chairman appointed from the outside wishes to minimize the loss of the members appears closest to the problem of the accounting policy making bodies. In order to use this approach for accounting the assumptions of spatial analysis must be examined for this specific situation.

Representation of Individuals for Accounting Issues

The availability of individual preferences must be considered. When asked, users and suppliers of accounting information can state preferences for accounting alternatives. Several studies have found that different groups have different preferences for information. Furthermore authors
have explicitly or implicitly accepted the existence of user preferences.

Spatial analysis assumes that an individual's preference function is unimodal. Considering the discussion of information overload in the accounting literature there is a point after which users do not find more information better. Suppliers of information also appear to have an ideal point. Given the discussion in Section II his preferences would decrease rather sharply. Indeed, little research has been undertaken regarding the shape of user or supplier preference functions. Based upon research in other disciplines, it will be assumed that preferences can be represented by certain metrics.

The Issue Space for Accounting Policy Making

If an individual's preference is going to be represented in a metric space then some indication of the title of each issue is required. The accounting literature has suggested that there exists certain conflicting criteria for selecting among accounting policy alternatives. One study has suggested four criteria, relevance, verifiability, freedom from bias and quantifiability, for determining accounting policy. Snively felt

84 For example see Chapter III, Section III.
85 These criteria are discussed in Appendix B.
that there are four levels of hierarchy to the criteria. His overriding criterion is usefulness. In order for information to be useful it must have his second level criteria of relevance, reliability, understandability, significance, sufficiency and practicality. He believes that verifiability and freedom from bias are criteria used to indicate reliability. Kenley and Staubus suggest the requirements for useful information are relevance, reliability, comparability, neutrality, timeliness, understandability, optimal disclosure and format. The Trueblood Committee suggested the criteria of relevance and materiality, form and substance, reliability, freedom from bias, comparability, consistency and understandability.

These conflicting criteria have been developed primarily without empirical information on the preferences of interested individuals. There is no guarantee that interested individuals make their decisions about alternatives according to any of these criteria. Furthermore, one study indicates

adequate fulfillment of these criteria does not require complete adherence to any one or all of these standards under all circumstances.

Even if individuals use the same criteria, they may have different preferences based upon different rankings of the importance of the criteria. Therefore, at least three levels could represent the issues used by

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88 Kenley and Staubus, "Objective," pp. 52-58.
90 Committee to Prepare a Statement of Basic Accounting Theory, Statement, p. 8.
interested individuals in making preference decisions regarding accounting policy alternatives. These levels are:

1. the policy alternatives themselves
2. certain criteria
3. factors affecting criteria

Users could be making their decisions about policy issues on

1. the type and quantity of information provided
2. criteria suggested in accounting literature or
3. criteria different from those suggested in the accounting literature
4. on factors which are perceived to be important in setting criteria

For example a user faced with making an investment decision may prefer one set of financial statements to another set of financial statements because

1. one has price level adjusted accounting information and the other does not have this information
2. he feels one is more useful than another
3. one has price level adjusted information and historical cost information which is more useful than the other which does not have this information.

The criteria cited from the accounting literature are user oriented. These studies do not consider supplier criteria.

The cost of accounting...is neglected here because we are not able to present any generally applicable observations about it beyond the obvious necessity to compare the cost and value of information.91

91Kenley and Staubus, "Objective," p. 52.
From Section II, suppliers are primarily concerned with criteria related to the cost and feasibility of providing the signals.

Economics has tended to use goods as the appropriate level of analysis. Information from accounting systems can be considered as goods that individuals consume. Furthermore production costs are incurred in supplying the information. In managerial accounting, information from an information system have been viewed as an economic resource having a cost and benefit. However, financial accounting has no indication about the level at which individuals make decisions about alternatives. One of the purposes of the proposed empirical study is to provide information about the issues considered by individuals.

If, as the accounting literature suggests, certain policies are interrelated, an empirical test of individual preferences can be undertaken to confirm the relationship. If the ideal points of individuals can be represented as a set of points colinear and perpendicular to a policy issue, that issue may not be related to the other issues. For example, two policy issues, Issue #1 and Issue #2, could be used by individuals in determining preferences for accounting policy alternatives. An empirical investigation of individuals' preferences might result in ideal points for the individuals, $x_1$, as shown in Figure 11. Furthermore any alternative not on the line segment determined by $x_1$, $x_2$ and $x_8$ is evaluated by

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94 See Chapter III Section III.
individuals based on its projection to the line segment. For example, in Figure 10, a\textsubscript{1} is evaluated according to policy alternative x\textsubscript{1}. These results from an empirical investigation indicate that individuals are making their decisions based only upon Issue #1.

\begin{figure}
\centering
\includegraphics[width=0.5\textwidth]{figure10.png}
\caption{Reduction in the Issue Space}
\end{figure}

Certain Information Representing Issues

In this chapter and those following, consistent with economics, individuals are assumed to make decisions on the basis of the quantity of specific types of information provided.

More than one dimension may be required to represent a single accounting policy issue. At least two dimensions are necessary for an issue which includes two policy alternatives. To reduce this policy to a one dimensional representation by considering one alternative as a percentage of the total information would omit the effects of quantities of information. For example Issue #1 can be the quantity of disclosure relative to some accounting alternative, A\textsubscript{1}, and Issue #2 can be the quantity of disclosure relative to another alternative, A\textsubscript{2}, for a policy issue. Let Q represent the quantity of information relative to an alternative.
Suppose \( x_1 \) is \((2Q[A_1], 2Q[A_2])\) and \( x_2 \) is \((Q[A_1], Q[A_2])\) where \( Q[2A_1] = 2Q[A_1] \). If measured as a percentage of the total quantity of information then \( I_1 \) and \( I_2 \) would prefer the same alternative for \( \frac{2Q[A_1]}{2Q[A_1] + 2Q[A_2]} \).

\[
\frac{Q[A_1]}{Q[A_1] + Q[A_2]}
\]

This is shown in Figure 11.

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**Issue #2**

\[
\begin{array}{c}
\text{Issue #2} \\
\hline
\text{X}_2 \\
\text{X}_1 \\
\text{Issue #1} \\
\end{array}
\]

- **a) Each Issue**
  
  \[
  \begin{array}{c}
  \text{X}_1 \\
  \text{X}_2 \\
  \end{array}
  \]

  Percentage of Issue #1 to total

- **b) Issue #1 as a percentage of the total information.**

**Figure 11** Alternative Representations of Two Issues

Accounting policy making was concerned with one dimensional issue space. The issue may not have been a policy issue but the representation of one policy alternative. One task force assignment of the FASB is to consider the presentation of price-level adjusted financial statements, other valuation policy alternatives are not being examined. A representation of this issue in a one dimensional issue space is shown in Figure #12.

---

**Figure 12** Price-Level Adjusted Information Issue
The dimension could represent the number of items on a financial statement which are presented using price-level adjustments or the number of lines relative to information regarding price-level adjustments. This policy alternative, however, may not be unidimensional because a count may not adequately consider the preferences of individuals for certain types of price-level adjusted information. For example the inclusion of price-level adjusted information on long-lived assets, which are currently stated in terms of the cost at time of purchase, may evoke different opinions than price-level adjusted information on current assets.

Restriction of Policy Alternatives

The number of accounting policy alternatives considered by individuals for a policy issue tend to be less than the number of mathematically possible alternatives. For example the general valuation issue considers several solutions under the concepts of direct and indirect valuation. On an a priori basis, some of the policies may be omitted from consideration. The Trueblood Committee, for example suggests that historical cost, exit values, current replacement cost and discounted cash flows should be used. Without introducing constraints on possible solutions, there are no irrelevant alternatives. Indeed Arrow has suggested that if the number of alternatives is increased the theorem can be avoided.

Objectives of Accounting Policy Making Bodies

In spatial analysis of voting situations as the distance from an

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96 Study Group on the Objectives of Financial Statements, Objectives, p. 35.
97 Arrow, Social Choice, pp. 112-114.
individuals ideal point to the candidates point is assumed to increase
the probability of voting for a proposed candidate decreases. The bene­
vvolent dictator is trying to maximize the benefits of all individuals.
Therefore his goal is to find a position which minimizes distance. The
analogy to voting in accounting is that as an individual's distance from a
policy alternative increases, the individual will object to that alterna­
tive if considered or if selected he will try to have it changed by
bringing pressure on the FASB. Failing to have the policy changed by the
FASB he will try to influence the SEC. If this fails he will try to
influence others. The FASB's goal might be to reduce the pressure
placed on these other groups. Seemingly, mild objections as indicated by
smaller distances can be tolerated far better than larger distances.

A certain distance might be used to distinguish satisfactory from
unsatisfactory policy alternatives to the individual. This is consistent
with the suggestion that individuals do not maximize but merely search
until a satisfactory solution is found.

The rational model [maximization] began as a description
of how people ought to solve problems rather than how
they do solve them. Somewhere along the line this dis­
tinction became blurred; researchers and even industrial
problem-solvers now sometimes treat the rational model
as though it were a description of the way people
actually behave in problem situations.

Individuals may be willing to accept a number of alternatives before
becoming dissatisfied and voicing that dissatisfaction. This is because

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98 Notice the analogy of this with the problem of the investment
credit and leases discussed in Chapter 1.
99 Caplan, Management Accounting, pp. 27-29.
100 Harold J. Leavitt, Managerial Psychology, 3rd Ed., (Chicago:
The University of Chicago Press, 1972), p. 64.
of the realization of the cost of securing that alternative. The last alternative which is found to be acceptable can be considered to mark an aspiration level for that individual. While supporting his most preferred alternative, he will strongly object to policies outside that area (Figure 13).

![Diagram](image)

**Figure 13** Aspiration Level Represented by a Euclidean Metric

In managerial accounting there has been some interest in the affects of aspiration levels and budgets on individuals. For financial accounting, it might be desirable to maximize the number of individuals who find a given policy acceptable. This will reduce the number who find the policy unacceptable and object to it.

**Summary**

For at least two groups of interested individuals, preferences for accounting information are different. Only in certain restricted situations will all members of one of these groups have exactly the same

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preferences. There is no reason to believe that other types of users will necessarily have the same preferences as any investor. Therefore, accounting policy making bodies must consider these conflicting preferences in determining accounting policy. The environment in which the FASB operates prohibits all but one social choice method from being used. Spatial analysis has been introduced as a method that can be used by the FASB. The assumptions required for spatial analysis of previous social choice situations have been shown consistent with those of the accounting policy making situation. The examination of the assumptions required for spatial analysis in accounting policy making has shown that further research is needed. Furthermore the objectives of the FASB or interested individuals may be different from those of other social choice situations. The next chapter presents a decision model based upon spatial analysis for use by the FASB in setting accounting policy.
CHAPTER III

Accounting Policy Making: A Different Approach

The first section presents a decision model for accounting policy making which uses spatial analysis and location theory to help select among accounting policy alternatives. Several formulations of the decision model consistent with the previously discussed goal of accounting policy making are introduced. Constraints on policy alternatives represent the restrictions that are placed on policy decisions by other organizations. The locations of possible optimal policies restrict the search of the FASB among a potentially large number of policy alternatives.

The next two sections examine variables included in the decision model. In the second section, methods of determining weights for assessing the significance of individuals are discussed. First, the historical use of weights is reviewed. Next, axiomatic approaches for setting weights are considered. Finally, specific methods of setting weights are determined suitable for accounting policy making situations. In the third section, multidimensional scaling (MDS) is introduced as a method of providing preference information consistent with the requirements of the model. Furthermore MDS may provide information that can be used to classify individuals and provide insight into the issues used by individuals in making decisions regarding policy alternatives.
Section 1

The Decision Model

In this section a decision model consistent with the goal of accounting policy making is developed. Spatial analysis provides a general framework for the model. The model developed in this section will be referred to as a general decision model to differentiate it from those models used to examine individual decision making.

Previous Approaches to Accounting Policy Determination

The FASB must select among alternatives whose effects on individuals cannot be guaranteed to be the same. Previously accountants have relied on methods to select alternatives which can be classified as the "historical communication" approach. These methods are unacceptable since individual differences are not considered. Another approach, a micro decision model one, examines models of individual decisions. These models closely resemble the decision processes of individuals. Some of the problems associated with this approach for a large number of interested individuals can be seen from the two person situation discussed in Chapter II. Primary among these problems is the difficulty of using the micro decision model except in very restricted settings. Due to the heuristics involved in decision making, the development of an adequate micro decision model is questionable. Demski concluded that

the accountant can neither objectively specify the precise information requirements of the system nor objectively evaluate the effectiveness of any specific set of information provided to the system.¹

Furthermore the development of a model at a given point in time will not guarantee its future applicability.

Even if micro decision models can be specified, aggregation of all interested individuals is still required. A social choice decision can be made only when everyone uses the same micro decision model with the same partition of the facets of the model. This is unlikely since the objectives and the experiences of different individuals will differ. Consequently, the micro decision model is just one method of providing information about individuals that can be used as input into a social choice method.

A Different Decision Model Approach

The decision model includes the depiction of the relationships among the recognized factors in a particular situation; it emphasizes the key interrelationships and frequently omits some unimportant factors.²

As previously discussed, certain factors are important in setting accounting policies. The preferences of interested individuals have been emphasized. However, since accounting policy makers have stressed the importance of certain interested individuals over others, the preferences of these individuals should count more than others.

Constraints on solutions should be introduced into this macro-like decision model because accounting policy making bodies consistently consider only a limited number of alternatives for a specific policy issue.

Certain alternatives may be infeasible on an a priori basis because of factors such as cost, lack of technology or inability of the policy making body to require certain alternatives. For example, the policy making body may find technology is available and costs are reasonable but certain influential groups are so opposed to these alternatives that their selection is not feasible.

The model is a decision model because its purpose is to assist in selecting among available policy alternatives. The use of spatial analysis allows a mathematical and geometric representation of the decision situation. In economics it has been noted that mathematics provides a set of tools which facilitates the derivation and exposition of the economic theories...mathematics provides the economist with a set of tools often more powerful than ordinary speech in that mathematics possesses concepts and allows operations for which no manageable verbal equivalents exist.3

Assumptions

Every individual is assumed to have an ideal point for a set of issues which can be located in a metric space.4 In addition, minimizing the loss incurred by an individual in selecting the best alternative subject to constraints is assumed equivalent to maximizing the benefits obtained by an individual. In the first situations discussed in this section, the constraints are other individuals' ideal points. The measure of individual loss can be assumed to be represented by certain distance functions. The goal of accounting policy making can be operationalized in several ways by selecting a policy so that the measure of distance between

3Henderson and Quandt, Microeconomic Theory, p. 4.
4See Appendix I.
the policy selected by the policy making body and the ideal points of the interested individuals is minimized. Since one group, the policy making body or its representative is measuring individual preferences, comparisons among individuals are possible.

For this section, a two dimensional issue space will be assumed. The issues will be described as Issue #1 and Issue #2. Individuals are assumed to make decisions about proposed policy alternatives based upon the quantity of these two issues provided by the alternatives.

The Model

Let the variables considered important be defined as:

\[ x_i = (x_{i1}, x_{i2}, \ldots, x_{im}) = \text{the point that represents the most preferred position of the } i\text{th individual, } (i = 1, 2, \ldots, m) \text{ on issues } (x_1, x_2, \ldots, x_n) \text{ as measured by information received from the individuals.} \]

\[ v_j = (v_{j1}, v_{j2}, \ldots, v_{jm}) = \text{the point that represents a possible position } j = (1, 2, \ldots, m_{\infty}) \text{ of the policy making body on all issues. } v_j \text{ can be considered a possible policy alternative.} \]

\[ v^* = \text{the optimal policy selected from the policy alternatives.} \]

\[ d_i(x_i, v_j) = \text{the metric which represents the policy making body's perception of the loss for the } i\text{th individual by the policy making body selecting alternative } v_j \text{ as the policy.} \]

\[ w_i = \text{a scalar that represents the policy making body's} \]
opinion of the importance of the $i$th individual

where $w_i > 0$.

The general macro decision model is

$$V^* = f [w_j, v_j, x_i, d_i (\cdot, \cdot)]$$

(1)

Since the formulation is concerned with loss of individuals, the objective is to minimize loss. Two approaches have been suggested frequently for maximizing the benefits of a group. One is to maximize a product of the weightings and value of alternatives for all individuals. The second one, the maximization of a sum of the value of alternatives has received more attention. In this formulation, the minimization of the product of weights and losses has multiple solutions. To minimize the loss using the product approach a policy which is one individual's ideal point selected without regard to weights, the value of the objective function will be minimized at zero. Therefore, the objective function, $f$, will be considered an additive one. Two alternative additive objective functions will be examined. In the first, used previously in spatial analysis, the objective is to minimize the weighted sum of the losses of all individuals. In the second, not previously examined, the objective is to minimize the number of individuals who find the policy unsatisfactory.

Formulations of the Objective Functions

Much spatial analysis has assumed that the goal in certain situations is to minimize the weighted sum of all individuals' losses. This is shown in the following formulation:

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5 See Chapter III Section II.
This formulation is unconstrained because all alternatives are possible solutions.

As discussed in Chapter II, individuals may be willing to accept certain policy alternatives without strenuous objection. However, once a certain distance away from an ideal point is reached, the individual finds all other alternatives unacceptable. Alternatively, the FASB may desire to minimize the number of individuals whose loss is higher than a certain level. This critical level will be represented by the distance \( S_i \) for the \( i \)th individual from his ideal point. An objective of the policy making body consistent with the previously discussed goal is to minimize the number of individuals outside their acceptable region \( d_i(x_i, v_j) \leq S_i \). This problem can be seen as a variant of the problem of locating a fixed number of emergency facilities such that the number of areas outside a
specific distance from a facility is minimized. This accounting policy making objective can be structured into the formulation used for location theory. The number of policy alternatives that can be selected by the policy making body is one. By including the weights of each individual, the problem for this accounting policy making objective is:

\[
\begin{align*}
\text{Min} & \quad \sum_{i=1}^{n} w_i v_i \\
\text{subject to:} & \quad \sum_{j \in N_i} \Delta_j + v_i > 1 \quad i = 1, 2, \ldots, n \\
& \quad \sum_{j=1}^{m} \Delta_j = 1
\end{align*}
\]

where \( m \) = the possible policy alternatives (where \( m \to \infty \))
\( p = 1 \) = number of policy alternatives selected
\( n \) = the number of interested individuals

---

6The basic problem in location theory of locating a fixed number of emergency facilities such that the number of areas outside a specific distance from a facility is minimized can be represented as:

\[
\begin{align*}
\text{Min} & \quad \sum_{i=1}^{n} y_j + u_i \\
\text{Subject to:} & \quad \sum_{j \in N_i} y_j + u_i > 1 \quad i = 1, 2, \ldots, m \\
& \quad \sum_{i=1, i \neq 1}^{n} y_j = p
\end{align*}
\]

where \( p \) = the number of emergency facilities to be provided
\( n \) = the possible number of sites available where \( n > p \)
\( m \) = the number of areas to be served
\( N_i = \{i \mid d(i, j) < S_i\} \) area around \( i \) which is within a distance of \( S_i \).
\( u_i \) = slack on the \( i \)th constraint
\( y_j = \begin{cases} 
1 & \text{if facility site } j \text{ is used} \\
0 & \text{otherwise}
\end{cases} \)
\( u_i = \begin{cases} 
1 & \text{if area } i \text{ is not served by a facility within a distance of } S_i \\
0 & \text{otherwise}
\end{cases} \)

\( V_j = \begin{cases} 1 & \text{if policy alternative } j \text{ is selected} \\ 0 & \text{otherwise} \end{cases} \)

\( V_i = \) slack on the \( i \)th constraint

\( V_i = \begin{cases} 1 & \text{if individual } i \text{ is not within } S_i \text{ of the selected policy} \\ 0 & \text{otherwise} \end{cases} \)

\( N_i = \{ i \mid d(x_i, x^1) \leq S_i \} = \) area around \( x_i \) which is within a distance of \( S_i \).

\( w_i, S_i \) as defined previously.

The first constraint of formulation (3) corresponds to the distance measure of formulation (2). The second constraint corresponds to the requirement of finding the best optimal policy for formulation (2). The constraints included in formulation (3) do not result in reducing the optimal policy to a specific feasible region. Therefore, both formulations can be considered as mathematical programming problems without any constraints on the feasible region.

In certain situations formulation (3) presents an interesting result. Let individuals be represented as shown in Figure 14 and \( w_1 = 2w_2 \). The solution for the situation shown in Figure 14b, denoted by diagonal lines, is some point in the intersection of the satisfactory regions for \( I_1 \) and \( I_2 \). For the situation shown in Figure 14a, the solution is any point such that \( d(s_i, v) \leq S_i \). Since the goal of accounting policy is operationalized to minimize dissatisfaction, policy alternative B in Figure 14a should be preferred to policy alternative A. Formulation (3) is not rich enough to differentiate between these two alternatives. Once the policy making body has minimized the number of individuals considering their importance who find the policy unsatisfactory, it should minimize the level of dissatisfaction of those who are not satisfied. Formulation (4)
presents an objective consistent with this purpose.

\[
\min_{i=1}^{n} \sum_{j \in N_i} v_i v_j \left[ Q + d_i(x_i, v_j) \right]
\]

subject to: \[\sum_{j \in N_i} v_j + v_i > 1 \text{ for } i = 1, 2, \ldots, n\]

\[
m \sum_{j \neq i} v_j = 1
\]

where \(Q\) is a large number.

So long as \(Q\) is large, formulation (4) can be viewed as a two step problem. First formulation (3) would be applied and if \(v^*\) is not completely determined then one can apply the following:

\[
\min_{v_j} d_q(x_q, v_j)
\]

subject to: \(v_j \in D_i^*\)

where \(q\) are the individuals not satisfied \(q = (1, 2, \ldots, g)\) and \(n \geq g\).

\(D_i^*\) is determined by formulation (3).

The area \(D_i^*\) may be determined by formulation (3) in three ways. In the first, \(D_i^*\) is restricted to only one individual's satisfactory region.

This restriction is indicated in Figure 14a by diagonal lines for two individuals, \(I_1\) and \(I_2\), whose satisfactory regions are represented by a Euclidean distance from their ideal points. In the second situation, \(D_i^*\) results from the intersection of several individuals' satisfactory regions. This is shown in Figure 14b for two individuals whose satisfactory regions are represented by a Euclidean distance from \(I_1\)'s ideal point and by a Sup distance from \(I_2\)'s ideal point. This solution is more restricted than the solution under the previous situation. In these two situations, the second step, formulation (5), can be applied to find an
a) Individuals' satisfactory regions do not intersect

b) Individuals' satisfactory regions intersect

Figure 14 Geometric Representation of Two Individuals' Preferences
optimal solution consistent with the formulation of the goal of accounting policy making. In the final situation, the intersection of satisfactory regions is such that a unique solution is determined. The second step is unnecessary for this situation. When discussing formulation (3), the additional step, formulation (5) will be assumed to be applied to find a solution consistent with formulation (4).

Comparison of Solutions for Formulations (2) and (3)

If both formulations result in the same optimal solution, the policy making body can use either formulation of its goal. The policy making body does not have to be concerned with the two ways individuals might consider the importance of their losses. Therefore, the first question that must be considered is whether formulation (2) and formulation (3) will result in the same optimal solution. For three individuals using the same metric to measure loss, the optimal solution may be different for each formulation. Let the distance between each individual's ideal point be greater than 2S, \[ d(x_i, x_j) > 2S \text{ for } i \neq j \]. Furthermore equal weights for all individuals will be assumed, \((w_1 = w_2 = w_3)\), and each individual's loss can be measured by a Euclidean metric. As can be seen in Figure 15, the optimal solutions are different. Point A represents the optimal policy alternative using formulation (2). The optimal solution to formulation (4) is any point \( C_p \) such that \( d(x_i, C_p) < S \). Six such solutions are shown in Figure 15.

If all individuals' ideal points are within S distance of each other, the optimal solution under both formulations can be the same. The history of accounting policy determination suggests that it is unlikely that all of the individuals' ideal points can be located so that all formulations
give the same optimal solution. Consequently each formulation for accounting

Figure 15 Geometric Representation of Solutions for Three Individuals

Implications of Formulations (2) and (3)

One of the problems associated with accounting policy making is the potential requirement of examining a large number of possible policy alternatives. This is recognized in formulations (2) and (3) because an infinite number of possible policy alternatives, \( \mathbf{V}_j \) \( (j = 1, 2, \ldots, m^1 \to \infty) \), may have to be examined to determine an optimal policy, \( \mathbf{V}^* \). The policy making body must be in a position to reduce the number of policy alternatives examined without eliminating the optimal solution from consideration. The formulations may provide methods of reducing the search for an accounting policy to some subset of possible policy alternatives while insuring that the global optimal policy will still be obtained. For example, in linear programming, the simplex method is a procedure for systematically examining a finite set of possible solutions to determine an optimal solution. Therefore, methods of reducing the search of policy alternatives for the two formulations will be examined. First situations without regard
to weights of individuals will be discussed for formulation (3). Then, situations considering certain weights for specific individuals for both formulations will be discussed.

Reduction of the Search for Optimal Solutions

Formulation (3) allows the policy making body to reduce the search for an optimal policy to those alternatives which are in the satisfactory regions of the interested individuals. This is shown in the following theorem:

(3.1) For Formulation (3), the optimal solution, $\mathbf{v}^*$, will be in some individual's or individuals' satisfactory region, that is $d_i(x^*_1, \mathbf{v}^*) \leq S_i$ for some $i$.

A method of further reducing the search for formulation (3) is to consider only those alternatives which are in the convex hull of the extreme points. This would allow the policy making body to consider only those alternatives which are inside the area formed by the extreme individual ideal points and inside the individuals' acceptable regions. Two cases will be examined. In the first case, individuals will be restricted to being represented by the same metrics but can have different weights on the issues. The second case will allow individuals to be represented by different metrics. For case one, three individuals, $I_1$, $I_2$, and $I_3$ are represented by ideal points $x^*_1$, $x^*_2$ and $x^*_3$ shown in Figure 16. $I_3$ prefers more of Issue #1 than Issue #2 while $I_1$ and $I_2$ have equal preferences for each issue.

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7 For a discussion of formulation (2) see Wendell and Thorson, "Mathematical Study," and "Location Theory."

8 Proofs appear in Appendix C.
All individuals can be represented by a Euclidean metric and their weights are equal, $w_1 = w_2 = w_3$. The convex hull of the extreme points is the triangle, including the interior, formed by $x_1$, $x_2$, and $x_3$. Figure 16 shows that the solution, $B$, is outside the convex hull of the extreme points.

Figure 16 Geometric Representation of Three Individuals who are represented by the same metric but are allowed different weightings

For the second case, $I_3$ will be represented by another metric, either the City Block or Sup metrics. From Figure 17, the solution, $C$, is once again outside the triangle formed by $x_1$, $x_2$, and $x_3$.

Figure 17 Geometric Representation of Three Individuals who are represented by different metrics

Reduction of the Search for Optimal Solutions Given Certain Weights

As might be expected, the actual weights of and the empirically
determined ideal points for interested individuals may insure a solution in the convex hull of the extreme points. This is particularly evident for formulation (2). In Figure 17, if $I_2$ is weighted as unimportant, $(0 < w_2 < \varepsilon)$ where $\varepsilon$ is some number which approaches zero, the optimal solution, $v^*$, may be outside the convex hull of the extreme points. In Figure 17, the point $C$ represents this possibility. By considering a large number of individuals whose ideal points are in the convex hull of $x_1, x_2,$ and $x_3$, the likelihood of a solution outside the convex hull is extremely remote.

The importance of weights can be seen in the following theorem:

(2.1) For formulation (2), if $d_i(\cdot, \cdot)$ is the same for all individuals and $w_k \geq \sum_{i=1}^{n} w_i$, then $v^* = x_k$.\(^9\)

However, all interested individuals' losses may not be represented by the same metric. The following four theorems consider the possibility that individuals may be represented by either the Euclidean, City Block or Sup metrics.

(2.2) If $w_k \geq \sum_{i=1}^{n} w_i$ and individuals can be represented by the Euclidean, City Block or Sup metrics, in order to have an optimal solution different from the $k^{th}$ individual's most preferred position, $x_k$, then

$$1 \leq \sum_{i=1}^{n} \frac{w_k}{w_i} \leq \frac{d_a(x_k, v^*)}{d_k(x_k, v^*)}$$

if $i \neq k$

where $d_a(x_k, v^*) = \max_i d_i(x_k, v^*)$

In order to have an optimal policy other than $x_k$ the way one individual

views his loss must be at least a certain proportion greater than the way \( I_k \) views his loss. Figure 18 presents the three metrics considered previously in two dimensions. Figure 18 shows that the greatest increase in the measure of distance occurs if \( I_k \) uses a Sup metric and \( I_a \) uses a City Block metric.

If \( I_k \), because of his position, is considered twice as important as the sum of the importance of all other individuals, then the optimal policy, no matter which of the three metrics are used to represent each individual, is \( x^*_k \).

\[(2.21) \text{ In a two dimensional space, if } I_k \text{ can be represented by either the City Block, Euclidean or Sup metric and } \]
\[w_k > 2 \sum_{i=1}^{n} w_i \text{ then } v^* = x_k. \]

However, there is no indication that one individual would be represented by such a high weight in relation to other interested individuals. Seemingly a further analysis of this relationship of weights and distance measures is necessary.

If \( I_k \) can be represented by a City Block metric and his weight is more than all other interested individuals combined, the optimal policy
is $x_k$ regardless of which of the three metrics are used by other individuals.

(2.22) In a two dimensional space if $I_k$ can be represented by a City Block metric and all other individuals by a City Block, Euclidean or Sup metrics and $w_k > \sum_{i=1, i \neq k}^{n} w_i$, then $v^* = x_k$.

This result can be extended to the case where the highly weighted individual, $I_k$, is represented by a Euclidean metric. In this case, if all others can be represented by a Euclidean or Sup metric, the optimal policy is $x_k$.

(2.23) In a two dimensional space if $w_k = \sum_{i=1, i \neq k}^{n} w_i$ and $I_k$ is represented by a Euclidean metric and all other individuals can be represented by a Euclidean or Sup metric, then $v^* = x_k$.

Since the policy making body might be concerned with formulation (3), the effect of weights on optimal solutions should also be considered. If one individual, $I_k$, is considered more important than all other individuals combined, the optimal policy will be in $I_k$'s acceptable region.

(3.2) For formulation (3), if $w_k > \sum_{i=1, i \neq k}^{n} w_i$, then the optimal solution, $v^*$, will meet the condition that $d_k(x_1, v^*) < S_k$.

Therefore the policy making body only has to consider those policy alternatives which this important individual considers satisfactory.

In accounting policy making one individual being weighted as more important than all other individuals combined is doubtful. However, the situation in which a group of individuals who hold similar preferences
may be weighted more than all others is a distinct possibility. For example, unsophisticated investors may be considered as more important than all other interested individuals combined. The previous theorems can be extended to groups of individuals, with the same ideal points and the same measure of loss.

\[(2.24) \text{ If } \sum_{i=1}^{n} w_i > \sum_{j=k+1}^{n} w_j \text{ where } x_1 = s_2 = \ldots = x_k \text{ and } d_1(x_1, v^*) = d_2(x_2, v^*) = \ldots = d_k(x_k, v^*), \text{ the results of (2.2), (2.21), (2.22), and (2.23) are appropriate for this situation.} \]

\[(3.21) \text{ If } \sum_{i=1}^{n} w_i \geq \sum_{j=k+1}^{n} w_j \text{ where } x_1 = x_2 = \ldots = x_k \text{ and } d_i(x_i, v^*) \leq S_i \text{ for } i = 1, 2, \ldots, k, \text{ the results of (3.2) are appropriate for this situation.} \]

**Summary for Unconstrained Situations**

A macro-like decision model has been introduced which includes variables that are of primary importance to accounting policy making. Two objective functions consistent with the stated goal of accounting policy making have been introduced. Not enough information is available to select one of the objective functions as the best for accounting policy making. The assumptions underlying each must be empirically examined and a more detailed statement of the objective of accounting policy making are necessary. Table 12 presents a summary of the two different assumptions underlying the objective function of each formulation. If individuals' preferences are found to be best measured by regions, formulation (3) is appropriate notwithstanding a more complete definition of the goal of accounting policy making. If individuals preferences are best measured
Table 12 Comparison of Formulations (2) & (3)

<table>
<thead>
<tr>
<th>Formulation of the Goal of the Policy Making Body</th>
<th>Measurement of Individual Preferences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimize total loss</td>
<td>on a continuous scale</td>
</tr>
<tr>
<td>Minimize Level of loss</td>
<td>4</td>
</tr>
</tbody>
</table>

on a continuous scale, the policy making body must further define its goal in order to select one of the two objectives represented by the formulations. The implications of the formulations for the restriction of the search for an optimal solution have been discussed.

Formulation (3) presents potential benefit over formulation (2). Formulation (3) allows the easy relaxation of the assumptions of symmetry. Considering the discussion of suppliers of accounting information and their most preferred position, they may not be indifferent to an equal increase or decrease in information. Thus the ability to relax the symmetry assumption may be important for accounting policy making. For formulation (3) any area can be used to describe an individual's satisfactory region. This region for a supplier of accounting information may appear as shown in Figure 19.

![Figure 19 Geometric Representation of a Supplier of Accounting Information](image)

In the case shown in Figure 19, the supplier would be willing to supply
more of Issue #1 than of Issue #2 before becoming dissatisfied. For this case, consistent with previous discussion, Issue #1 may represent a quantity of disclosure of historical cost information; Issue #2 may represent a quantity of disclosure from a new measurement system. Furthermore, formulation (3) lends itself to a graphical solution for nonsymmetric regions. Formulation (2) may be very difficult to use to determine an optimal policy for individuals with nonsymmetric preference contours. ¹⁰

Formulations (2) and (3) do not include any constraints on the location of an optimal policy. In the environment of the FASB, constraints may have an important affect on its decisions. Therefore, these formulations will be expanded to include constraints on optimal policies.

Constraints on the Selection of Optimal Policies

The formulations previously examined implicitly assumed that the optimal solutions were in the first quadrant so that $\nabla^* \geq 0$. No other restrictions on the optimal solutions were included. Constrained optimization problems have found important uses in business decision situations.¹¹ In accounting policy making possible solutions may have more restrictions than just nonnegativity. This can be the result of several factors. The technology may be unavailable to select certain alternatives as the solution.¹² Others may restrict the alternatives which the FASB can consider.


¹²See Chapter II Section II for an examination of this situation.
The SEC may restrict the alternatives available to the FASB. If the FASB does select an alternative which the SEC opposes, there is the real possibility that the SEC will overrule the policy adopted by the FASB. The classic example of this situation occurring is Congress' and the SEC's actions regarding the investment credit. Three members of the APB assented to the second opinion on the investment credit only because the SEC's action left them no other practicable choice. Finally the alternatives may be constrained because users desire no additional information regarding a certain issue.

**Representation of Constraints in the Decision Model**

The constraints on FASB actions in selecting among policy alternatives will be assumed to be represented by linear functions. Generally these will be inequality constraints. The possibility that a particular issue may have an equality constraint is recognized. For example the SEC may require a particular level of information for some issue. If the SEC is unwilling to accept more or less of this information, the constraint would be represented by a linear function. However, when an equality constraint occurs on an issue, the issue space can be reduced from n to (n-1) dimensions. Consider a two dimensional issue space where an equality constraint is imposed by the SEC on Issue #1. The alternative which the FASB must select for Issue #1 is A as shown in Figure 20. The policy making body can reduce the issue space to considering only the quantity of Issue

---

13See Chapter II, Section III for an example.
14The three members were Walter Frese, W. Crichley and Robert Trueblood. For their comments see "APB Opinion No. 4 (Amending No. 2) - Accounting for the Investment Credit," in APB Accounting Principles, p. 6518.
15It is recognized that nonlinear constraints are possible. However any nonlinear constraints are assumed to be represented by linear constraints.
If enough equality constraints are included, an optimal policy will be determined by the intersection of the constraints. In Figure 21, let \( v_1^1 = A \) and \( v_1^2 = B \) then \( v^* = (A, B) \).\(^{16}\)

\[
\begin{align*}
\text{Figure 20. Geometric Representation of An Equality Constraint on the Issue Space} \\
\text{Figure 21 Geometric Representation of Equality Constraints Determining an Optimal Solution}
\end{align*}
\]

\(^{16}\)The problem shown in Figure 21 can be represented by the decision model for Formulation 2 as:

\[
\begin{align*}
\min \sum_{j = 1}^{N} \sum_{i = 1}^{N} w_i [d_i(x_i, v_j)] \\
\text{subject to: } g_k(v) = B_k \quad k = (1, 2, \ldots, p) \\
\text{where } p = \text{number of constraints.}
\end{align*}
\]

Formulation 4 as:

\[
\begin{align*}
\min \sum_{j = 1}^{N_1} \sum_{i = 1}^{N_1} w_i v_j \\
\text{subject to: } \sum_{j = 1}^{N} v_j + v_1 > 1 \quad i = (1, 2, \ldots, n) \\
\sum_{j = 1}^{N_1} v_j = 1 \\
g_k(v) = B_k \quad k = (1, 2, \ldots, p)
\end{align*}
\]
In this situation, individual preferences can not be considered in determining the optimal solution. This can represent a spatial example of imposition without considering individuals' preferences.

Many of the constraints placed on FASB actions appear to be of an inequality type. For example, the SEC may require a minimum quantity of information on a particular issue. Information use by individuals and the technology available may place a maximum on the quantity of information on a particular issue.

The Decision Model with Constraints

First, formulation (3) will be revised to include constraints on the optimal policy selected. Then, formulation (2) will be revised. After the formulations are presented, the implications of the formulations for optimal policies will be examined. Formulation (3) with constraints on the policy that can be selected is:

\[
\begin{align*}
\text{Min} & \quad \sum_{i=1}^{n} w_i v_i \\
\text{subject to:} & \quad \sum_{j \in N_i} v_j + v_i \geq 1 \quad i = (1, 2, \ldots, n) \\
& \quad \sum_{j=1}^{m} v_j = 1 \\
& \quad g_k(v) \geq b_k \quad k = (1, 2, \ldots, r)
\end{align*}
\]

In order to examine a space of \( \mathbb{R}^n \) rather than one of \( \mathbb{R}^n \times \mathbb{R}^n \), a specific type of metric, a norm, will be used.\(^{17}\) Formulation (2) consistent with this type of metric and constraints on the policy selected is:

---

\(^{17}\)Appendix A provides a discussion of the relationship between norms and metrics.
Implications of Constraints on the Decision Model

For the examples included in this section, constraints are assumed to be placed on each issue. Furthermore, the restrictions on the quantities on each dimension may be related. Thus a constraint may be of the form:

\[ v_1^j + v_2^j \geq B_k. \]

With these assumptions regarding the constraints, the constraint set is convex.\(^{18}\)

The constraints may be nonbinding on the optimal solution. The location of individual preferences and constraints may indicate that the optimal policy is the same under the constrained or unconstrained situations. In Figure 22 with \( w_1 > w_2 \), the solution under formulation (3) is exactly the same as the solution under formulation (3c). However, the previous discussion of accounting policy determination makes this situation unlikely.

---

\(^{18}\) The constraints can be viewed as line segments between two points \( y_1 \) and \( y_2 \). A constraint can be defined as the set

\[ Z = \{ y \mid y = \lambda y_1 + (1 - \lambda)y_2, 0 \leq \lambda \leq 1 \}. \]

A function is defined as convex if \( f(\lambda y_1 + (1 - \lambda)y_2) \leq \lambda f(y_1) + (1 - \lambda)f(y_2) \). Therefore the linear constraint is a convex function. Since the intersection of convex functions is convex, the constraint set is convex.
A more likely situation is one in which some individuals' satisfactory regions are outside of the feasible set. As shown in Figure 23 the case of three individuals with $w_1 > w_2 + w_3$ and $w_2 > w_3$ will be examined. In an unconstrained situation (3.2) indicates the solution will be a $V^*$ such that $d_1(x_1, V^*) \leq S_1$. However for the case shown in Figure 23, this optimal solution is infeasible. Since $w_2 > w_3$, the optimal solution in this situation will be such that $d_2(x_2, V^*) \leq S_2$. For formulation (3c), anyone whose satisfactory region is outside the feasible set need not be considered. This is true regardless of the weights assigned.

(3c.2) For formulation (3c) if $I_i$ ($i = 1, 2, \ldots, k$) have preferences such that they are in the feasible region where $I_i$ ($i = 1, 2, \ldots, k, k + 1, \ldots, n$) and $w_j \geq \sum_{i=1}^{k} w_i$ where $I_j \in I_i$, then the optimal solution, $V^*$, will meet the condition $d_j(x_j, V^*) \leq S_j$.

Therefore the policy making body may be unable to satisfy those considered most important.
The objective function for formulation (2c) for the three metrics considered previously is a convex function. Therefore, formulation (2c) is a convex programming problem because its objective is to minimize a convex function over a convex constraint set. If the objective function is linear, which also implies a convex objective function, formulation (2c) is a linear programming problem. Formulations which include only the City Block and Sup norms can be reformulated as linear programs. For a linear programming problem a theorem states that if a finite solution exists then a finite optimal solution is an extreme point of the constraint set. If this theorem is appropriate, the search for an optimal solution by the policy making body can be greatly reduced. The simplex procedure is available to systematically search the extreme points for an optimal solution.

---

19 For Formulation (2c), the Euclidean, City Block and Sup metrics present convex objective functions for a single individual. Since \( w_i > 0 \), the objective function of formulation (2c) is a positive combination of convex functions. Therefore the objective function is convex because a positive linear combination of convex functions is convex.


21 There are four fundamental properties of linear programming upon which the simplex method is based. These allow the search for an optimal solution to be restricted to a finite number of possibilities. It searches these points until no further improvement can be obtained.
As shown in Figure 24, three individuals with equal weights represented by Sup norms have their ideal points inside the feasible set. Let $A_p$ represent the extreme points of the constraint set. By selecting a solution, $A_1 = x_1$, the value of the objective function is less than the value of the objective function for any extreme point, $A_p = \frac{3}{\sum_{i=1}^{3} w_i}, \quad x_1 < \frac{3}{\sum_{i=1}^{3} w_i} A_p, \quad x_1$ for all $p$. Therefore a better solution than an extreme point solution is located in the interior of the feasible set. By definition $A_p$ can not be an optimal solution. This might be the result of no constraints being binding for the optimal solution. Furthermore, the minimization problem considered in most primal-dual linear programming problems has a different constraint set. For two individuals with equal weights whose ideal points are represented in Figure 25 the unconstrained solution is $A_{uc}$. However this unconstrained solution is outside the feasible region. The parallel lines

![Figure 24 Geometric Representation of Three Individuals and Constraints](image)

22 When an inequality constraint is held as an equality in an optimal solution, it is said to be binding. In this case all constraints are nonbinding.

23 This minimization problem is:

Minimize $\sum_{i=1}^{n} c_i y_i$

subject to: $\sum_{j=1}^{n} a_{ij} y_j = b_i \quad i = (1, 2, \ldots, t)$

represent higher values of the objective function as they approach the feasible region. The optimal policy in this case is at an extreme point of the constraint set. Therefore in situations where all individuals are represented by either the City Block and Sup metrics and the unconstrained solution is outside the feasible region, the accounting policy making body may be able to reduce its search for an optimal solution to the extreme points of the constraint set. This would greatly reduce the search required to determine an optimal solution. Formulation (2c) with individuals' losses represented by Euclidean norms is not readily reformulated as a linear programming problem. However it is a convex programming problem. The optimal solution for this type of problem may be at a boundary point, an extreme point or in the interior of the constraint set. Optimal solutions for two individuals with different ideal points are shown in Figure 26. Since both individuals are represented by a Euclidean norm, the objective function can be represented geometrically as an

\[ \text{Issue \#2} \]
\[ \text{Issue \#1} \]

**Figure 25 Geometric Representation of a Decision Problem**

---

24 It is possible to approximate the objective function with a series of linear functions. Since the objective function is convex, a linear function between two points of the objective function will always be above the objective function.

25 A convex programming problem is one whose objective is to minimize a convex function over a convex set.
a. At an Extreme Point of the Constraint Set

b. At a Boundary Point of the Constraint Set

c. In the Interior of the Constraint Set

Figure 26 Geometric Representation of Possible Optimal Solutions
ellipse. While only restricting the required search to the feasible region, a convex programming formulation may allow the policy making body to find the optimal policy with greater ease. If a solution, $\Delta_j^*$ is a local solution, that is $\Delta_j^*$ is the best solution within some neighborhood around itself, then $\Delta_j^*$ is an optimal solution. Furthermore the constraints allow the policy making body to be concerned only with individual preferences in the direction of the constraint set. Therefore, assumption of symmetry about individual preferences is relaxed.

Summary

The macro-like decision model has indicated that interested individuals' ideal point locations, measure of loss and weights, as well as any restrictions on the optimal policy, will affect the number of policy alternatives which the FASB must examine in order to determine an optimal accounting policy. The location of ideal points and measures of loss may allow the objective function to be represented as one that reduces the search among policy alternatives. The weights assigned to each individual may also reduce the search. In this section, individuals' ideal points, measures of loss and weights were provided exogenously. Because of their importance in determining an optimal solution, the next two sections will examine methods that can be used to provide information about these variables.

26 An ellipse is the set of points whose average distance from two points is a fixed number. Let the two individual preferences be the foci of the ellipse. Then $(d(x_1, \Delta_j) + d(x_2, \Delta_j))/2 = e$ where $e$ is a fixed measure of distance. The equation can be changed to: $(d(x_1, \Delta_j) + d(x_2, \Delta_j)) = e'$ where $e' = 2e$. Therefore the figure having equal distance from two preference points using a Euclidean norm is an ellipse.

27 The main theorem of convex programming is that any local minimum is a global minimum.
Section II

Weights

The weights used can have an important effect upon the optimal solution. Let three individuals be represented as shown in Figure 27.

Without the weights being given there are a large number of possible optimal solutions. If formulation (4) is used the optimal solutions for various weights for the situation depicted in Figure 27 are shown in Table 13. Due to its effects on the optimal solution, the method of setting weights for the interested individuals is extremely important. In this section, prior methods used to set weightings for accounting policy making will be considered first. Then various axiomatic approaches used outside of accounting policy making will be discussed. Finally other methods of setting weights for accounting policy making situations are discussed.
Table 13 Optimal Solutions for Different Weights

<table>
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<tr>
<th>Weight</th>
<th>An Optimal Solution Meets The Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$w_1 &gt; w_2 &gt; w_3$</td>
<td>$d(x_1, \Delta^*) \in S_1$</td>
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<tr>
<td>$w_1 &gt; w_3 &gt; w_2$</td>
<td>$d(x_2, \Delta^*) \in S_2$</td>
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<tr>
<td>$w_1 = w_2 = w_3$</td>
<td>$d(x_3, \Delta^*) \in S_3$</td>
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<td>$w_2 &gt; w_1 &gt; w_3$</td>
<td>$d(x_1, \Delta^<em>) \in S_1$ or $d(x_3, \Delta^</em>) \in S_2$</td>
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<td>$w_2 &gt; w_3 &gt; w_1$</td>
<td>$d(x_1, \Delta^<em>) \in S_1$ or $d(x_2, \Delta^</em>) \in S_2$</td>
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<td>$w_2 &gt; w_1 = w_3$</td>
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<td>$w_3 &gt; w_1 &gt; w_2$</td>
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<td>$w_3 &gt; w_2 = w_1$</td>
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<tr>
<td>$w_3 = w_2 = w_1$</td>
<td>$d(x_1, \Delta^<em>) \in S_1$ or $d(x_2, \Delta^</em>) \in S_2$</td>
</tr>
</tbody>
</table>

Prior Weighting Methods Used in Accounting Policy Making

For much of their existence, accounting policy making bodies have been directly concerned with the preferences of two groups. One of these is the SEC. The recognition of gains and losses of marketable securities presents an excellent example of the importance of the SEC.
The SEC, armed with its own preferences and buttressed by industry reactions, informed the APB that it could not support flow-through. At this point, flow-through was a dead duck...28

The other important group was the profession itself and particularly the "Big Eight" public accounting firms. Without the support of the accounting profession, accounting policies had a difficult time gaining acceptance. Until 1964, APB opinions included a statement that:

Unless otherwise indicated Opinions present the considered opinion of at least two-thirds of the members of the Accounting Principles Board, reached on a formal vote after examination of the subject matter. Except where formal adoption by the Council or the membership of the Institute has been asked and secured the authority of the opinions rests upon their general acceptability.29

The importance of the "Big Eight" firms may be the result of two factors. They are large firms with resources and important clients. Without their acceptance of accounting policies, the policies would be difficult to enforce because the "Big Eight" firms audit over eighty per cent of the corporations listed on the New York and American stock exchanges.30 Furthermore each "Big Eight" firm had a representative on the eighteen member APB. The importance of these eight votes are seen in the method used by the APB to determine policies.

You sit there and you go down line by line and see if everybody approved and if not... The chairman is working to get twelve votes for approval.31

31Charles T. Horngren indicates this in Burns, Accounting in Transition, p. 97.
Another approach to gaining insight into the importance of alternatives is provided by the procedure followed by policy making bodies in policy pronouncements. The APB followed the practice of including the votes and reasons for qualified agreement or dissent in each pronouncement. Of the thirty-one pronouncements issued by the APB only four were accepted without qualification. This is shown in Table 14. In three of the remaining twenty-seven pronouncements no comments were included. Unfortunately many of the comments do not include reasons for a member's belief in other policy alternatives. However in those cases where a reason is indicated two factors are cited consistently. The first of these is a lack of theoretical basis for selecting the particular policy alternative. These objections are not surprising given the emphasis placed on research in the founding of the APB. The Committee that proposed the institution of the APB felt that "the results [of the postulates and principles studies], as adopted by the Board [APB] should serve as the foundation of future pronouncements."  

The other factor frequently cited as an objection to the particular policy alternative is usefulness to investors. The objection of not providing useful information by APB members is interesting in light of comments that members of the APB engaged in the practice of public accounting tended to present the views of their clients, who are suppliers of

---

32The FASB is still following this practice. The first three statements were adopted unanimously. The fourth statement, "Reporting Gains and Losses on Extinguishment of Debt," had one dissent with the reason for the dissent indicated. This practice is followed in other areas including the setting of auditing standards.

33"Report to Council of the Special Committee on Research Program," as reprinted in Zeff, Forging, p. 176.
<table>
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<tr>
<th>Opinion No.</th>
<th>Year</th>
<th>Title</th>
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<th>Qualified Assent</th>
<th>Dissent</th>
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Table 14 (continued)

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<td>11</td>
<td>4</td>
<td>3</td>
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</tbody>
</table>

*One member did not vote.

Unfortunately further information regarding how policy decisions were made when APB members had conflicting points of view is lacking. However decisions among policy alternatives were made and will continue to be made.

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34 Philip E. Meyer in an examination of the voting patterns of APB members concludes that members did not seem to be voting as representatives of external groups. However, as the author notes, the analysis of voting may not fully take into account support by members of particular groups, in "The APB's Independence and Its Implications for the FASB," Journal of Accounting Research, Spring, 1974, pp. 194-196.
Axiomatic Approaches

The use of a weighted sum of individual preferences to determine committee or group decisions has been examined by several authors. In this section three approaches presented by two authors, Christenson and Theil, will be examined. These approaches present examples of many of the other formulations. Christenson assumed that individuals maximize expected utility and a binary relationship of all alternatives exists for the group, and axioms of comparability, transitivity, substitutability, dominance and continuity hold for the group as a whole. Then it can be shown that the group choice should be governed by a weighted average of each individuals' preferences. Let $x_k$ be defined as before and $x_k^*$ be his least preferred preference. Furthermore let $x_k$ and $x_k^*$ be the same for all individuals. For any other alternative, $x$, a value, $\lambda$, can be found such that the individual is indifferent to $x$ or a mixture of $\lambda x_k - (1 - \lambda) x_k^*$ where $\lambda$ is defined as the probability of $x_k$ occurring. By defining the maximum benefit as one and the maximum loss as zero, it can be shown that the weight allocated to member $k$, $w_k$, is $\lambda_k$.  

Thiel's approach is based upon the committee preference function, $l_c(\lambda)$, such that

---


\[ l_c(\lambda) = w_i(p_i(x_j) - p_i(x_k)) \]

where \( p_i(\cdot) \) = the preference of the ith individual for the alternative

This function is based upon an individual's most preferred position, not his most and least preferred ones. In considering the problem of weights, Theil suggested that \( w_i(p_i(x_j) - p_i(x_k)) \) should be labeled as an individual's loss function. \( (p_i(x_j) - p_i(x_k)) \) is considered the "raw" loss function and \( w_i \) the "load" of the function. An individual's loss function is equal to the "load" times the "raw" loss function. Two weighting methods are suggested for the "loads" by Theil. In one method the "load" equals one and the "raw" loss function is equal to the individual's loss function and the individual's loss function is equal to the square of the "raw" loss function.

Applying Theil's first approach to the macro decision model since the distance, \( d(x_i, \Delta j) \), is an indication of the individual's loss function no weighting term is needed. Alternatively each \( w_i \) would be equal for all individuals. The model may be stated as

\[ \Delta^* = F(x_i, \Delta_j, d_i(,)) \]  

(11)

The second approach suggested by Theil is consistent with the macro-like decision model when the distance function, \( d_i(, ,) \), is squared.

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37 Christenson's approach may be considered to be part of this approach because his "raw" loss function is the value of the alternative to the member. It is then adjusted by a "load," \( \lambda_i \), to determine the individual loss function.

38 Theil, Optimal Decision, pp. 333-356.

39 Considering the representation of Figure 27 and Table 11, equal weights may have serious implications for what actions the policy making body should undertake. These actions are considered in Chapter IV Section I.
Methods of Determining Weights for Accounting Policy Making

Part of the problem of determining weights may be, as one author suggests, in describing the loss function as the weighted sum of the individual loss functions.

There is no formal objection to doing so, but it has the disadvantage that a weighting procedure of the ... members is suggested in the same way as a weighted price index number [which] is obtained by treating prices of important commodities. Evidently, this is not what we mean by "weighted sum of individual loss functions." What we wish to do is to treat all individuals "equally" (in accordance with fairly generally accepted ethical standards). But it must be admitted that at the present stage it is not very clear what "equally" really means.40

This section will examine possible standards that might be used in accounting policy making situations. Two general types of standards will be considered: 1) those that can be determined using only information of individual preferences and 2) those which require the collection of additional information. The first type of standard requires the macro-like decision model to have an optimal solution which is a function of \( x_i, A_j, d_i(,.) \). The second type of standards the optimal solution can be represented as \( \Delta* = (w_i, x_i, A_j, d_i(,)) \). One can think of the first type of standard as a subset of the second for \( w_i \) may be equal for all individuals. However this is an important decision because of the possible effects of weights on solutions. Therefore, the two types will be considered as separate classifications.

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40 Theil, Optimal Decision, p. 337.
**Type 1 Standards for Determining Weights**

For Type 1 Standards, three ethical standards will be considered. They are summarized in Table 15.

**Table 15 Ethical Standards not Involving Additional Information**

1. The willingness to take risk.
2. The loss that might be incurred by the individual not receiving his most preferred alternative.
3. All individuals count equally.

If the approach suggested by Christenson is followed, the weights can be considered a measure of the individual's willingness to take a situation which involves some risk over one which is a sure thing. The selection of $x_k$ and $\bar{x}_k$ can be viewed as the "reference contract" which is being used to compare all other alternatives. Since the accounting policy making situation involves both suppliers and users, the selection of the reference contract may not be the same for all individuals. For suppliers and users, the relationship might be reversed, that is $x_g = x_u$ and $x_u = x_g$. The ability to use the same measure of risk is suspect.

The macro-like decision model with $w_1 = 1$ for all individuals counts everyones losses equally. However those individuals with different perceptions may count more than others. Consider Figure 27 where both individuals can be represented by a Euclidean norm, $||x_1, \Delta_j||_2$. The measure of loss for an alternative $a$ is $||x_1, a||_2 + ||x_2, a||_2$. However, assuming that $I_2$ measures his loss by the City Block norm, $||x_2, a||_1$, the total loss is $||x_1, a||_2 + ||x_2, a||_1$. Clearly in this case $||x_1, a||_2 + ||x_2, a||_1 > ||x_1, a||_2 + ||x_2, a||_2$. 


This would be an example of the first approach discussed by Theil. It might be desirable to consider his second case where the square of the distance is considered the loss function. This causes those who suffer a greater loss to count even more than those who suffer smaller losses.

The third alternative would allow only a choice of accepting or rejecting an alternative or ranking a number of alternatives. If two policy alternatives, $\Delta_1$ and $\Delta_2$, being considered and $||x_1, \Delta_1|| > ||x_1, \Delta_2||$ then $I_1$ would rank $\Delta_2$ over $\Delta_1$. This ranking for all individuals would then have to be aggregated over all individuals. Notice that the last two methods tend to allow those considered unsophisticated investors to have a larger influence because they are greater in number compared to other interested individuals.  

Type 2 Standards for Determining Weights

The second group of ethical standards require additional information to determine the weights. These weightings are based on characteristics held by specific individuals. Table 16 presents some possible

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41 Sophisticated investors have been considered as the top of a triangle while unsophisticated investors have been considered the base of a triangle representing all investors according to George J. Bissell, "A Professional Investor Looks at Earnings Forecasts," Financial Analysts Journal, May-June, 1972, p. 73.
characteristics that might be considered.

Table 16  Ethical Standards Involving Additional Information

1. Position of the individual in the accounting information system.
2. An individual's use of information generated from the accounting information system.
3. An individual's influence with other public sector organizations.

All three standards have been proposed or used for accounting policy making. Each standard could be operationalized in a number of different ways. For example the first standard could be interpreted as the amount invested by users in the stock market.

This classification is applicable to users. Some other methods, perhaps involving the costs of being publically traded, must be used for suppliers. The two groups must then be compared with each other. For the third standard one might use the measure of funds expended on elections and lobbying or some other measure of influence. One operationalized standard may be difficult to justify over others.

One possibility that must be considered is that the policy making body will select a weighting system that will give the optimal solution that it desires. If the weights are determined after the other variables of the decision model have already been determined, this is a very real possibility. If the weights are determined before the other variables, in order to get the optimal solution the policy making body requires perfect knowledge of individual preferences. If the policy making body were able to set the weights so that their preferred solution is the optimal solution without regard to interested individuals' views, objections to the decisions of the policy making body should increase. But there is some
check on the policy making body's ability to arbitrarily set the weights. Perhaps, an explicit statement of the method used to determine weights can reduce the likelihood of arbitrary weights. This does not eliminate the possibility of individuals misrepresenting variables included in the decision model. However in order to have the desired effect, the individuals must be in a position to perfectly estimate all other variables.

Summary

In this section possible methods of determining weights for interested individuals have been considered. These methods are not exhaustive of all possible methods. They do, however, present a variety of alternatives. Due to the assumptions required for certain ethical standards and the multiple operational standards for certain other ethical standards, a best policy has not been determined. For the next chapter, a method of determining weights is assumed to have been selected so that undesirable properties are minimized.

Section III

Individual Preferences

Several methods are available for determining individual preferences in an issue space. These methods can be divided into two categories which will be identified as ad hoc and formal. The difference between the methods is the procedure used to locate the individuals most preferred point and the measures of their losses in the issue space. In the ad hoc category, individuals are represented without any formal criteria for placing them in the issue space. This category includes methods in which the representation of individuals is based on anecdotal or nonempirical
information. These methods are suspect because of the uncertainty associated with the classification.

The formal methods require the systematic collection of data on the views of individuals on various objects. This data is processed by techniques to provide the necessary individual preferences. This group of methods is formal in the sense that explicit procedures and criteria are used to determine the issue space and individual preferences. Two methods have been used in psychological research to provide this information. One is based on clustering. Its purpose is to categorize the data into groups. The macro-like decision model requires more information than just clusters. The macro-like decision model requires a method that gives a spatial representation of the data which meet the criteria for an issue space. The other method, multidimensional scaling, has been used to provide the type of information required for the macro-like decision model. The purpose of multidimensional scaling (MDS) is to provide insight into the structure by providing a correspondence between perceptions and geometric distance.

Multidimensional Scaling

MDS includes a variety of methods with this common goal. There are several different classification structures for MDS. Shepard considers a structure based upon the types of data that are used in MDS. The four types are proximity, dominance, profile and conjoint measurement data. Two of these four types, proximity and dominance data, are of interest for

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42Cluster information may, however, be helpful in the categorization of individuals.
43See Appendix D.
the macro-like decision model because they provide direct information about the relationships between objects. Proximity data is concerned with the relationship between alternatives. Proximity data might include information regarding the similarities or differences of alternatives. Dominance data is concerned with the preference between alternatives.45

Other classifications can be based on the types of questions asked or the methods used to generate the individual preferences in the issue space. Two methods that have been used extensively to generate proximity and dominance data are paired comparisons requiring the ranking or rating of objects.46 If n alternatives are being judged, n (n-1)/2 paired comparisons of the alternatives are required. Examples of methods used to elicit this information from individuals appear in Table 17. An example of data collection for proximity data using ratings and dominance data using

Table 17 Possible Data Collection Techniques for MDS

1. Ranking for alternatives J & K
   a. J is preferred to K
   b. K is preferred to J
   c. Indifferent between J and K

2. Rating for alternatives J & K

<table>
<thead>
<tr>
<th>Very Different</th>
<th>Very Similar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between J &amp; K</td>
<td>1  2  3  4  5  6  7  8  9</td>
</tr>
</tbody>
</table>

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ranking is presented. Rankings can be used to collect proximity data; ratings can be used to collect dominance data. The following numerical values can be assigned to each ranking:

1 if \( I_j \) prefers alternative J to alternative K
-1 if \( I_j \) prefers alternative K to alternative J
0 if \( I_j \) is indifferent to objects J & K

Therefore, a numerical value can be assigned to each relationship under either data collection method.

**MDS & Metric Spaces**

The perceptions should have certain characteristics. Since paired comparisons are being made, the geometric distance for all pairs considered similar should be equivalent. If \( C_i(j,k) \) is defined as the relationship between alternatives J & K stated by \( I_i \) and \( d_i(\Delta_j,\Delta_k) \) is defined as before,

1. If \( C_i(j,j) \sim C_i(k,k) \) then \( d_i(\Delta_j,\Delta_j) = d_i(\Delta_k,\Delta_k) \)

In addition the relationship between two similarly perceived alternatives should be less than the distance between two dissimilarly perceived objects.

2. If \( C_i(j,j) < C_i(i,j) \) then \( d_i(\Delta_j,\Delta_j) < d_i(\Delta_j,\Delta_k) \)

Furthermore the relationship should not be affected by the order of presentation.

3. If \( C_i(j,k) > C_i(j,j) \) then \( C_i(j,j) < C_i(j,k) \) and

\[
d_i(\Delta_j,\Delta_j) < d_i(\Delta_j,\Delta_k)
\]

Finally if a direct comparison is made between two alternatives and then a
comparison is made between the same two alternatives using a third one, the comparisons should be consistent. The similarity of these properties of perceptions to the properties of a metric are not apparent.\textsuperscript{47} Therefore MDS attempts to place points in a metric space which is the same requirement of the issue space.

**MDS Methods**

The goal of MDS is to have the output presented in a metric space as closely consistent as possible to the input relationships.\textsuperscript{48} Consistent with previous notation, the goal is:

\[ d_i(\Delta_j, \Delta_k) = f(C_i(j,k)). \]

If the function is assumed to be linear or polynomial, the technique is described as metric MDS. If the only restriction of the function is that


\[ This objective can be represented mathematically for rank order data as follows: In this case it will be assumed that the input is dominance data.

Let \( C_i(j,k) = 1 \) if \( I_i \) prefers \( j \) to \( k \)

\[ C_i(j,k) = -1 \] if \( I_i \) prefers \( k \) to \( j \)

\[ C_i(j,k) = 0 \] if \( I_i \) is indifferent to \( k \) & \( j \)

\[ d_i(\Delta_j, \Delta_k) = \text{preference of } I_i \text{ for object } j \text{ measured from his most preferred point, } x_i. \]

\[ d_i(\Delta_j, \Delta_k)' = (d_i(x_i, x_k) - d_i(x_i, x_j)) \]

where \( d_i(\Delta_j, \Delta_k)' > 0 \) if \( I_i \) prefers \( j \) to \( k \)

\[ d_i(\Delta_j, \Delta_k)' < 0 \] if \( I_i \) prefers \( k \) to \( j \)

\[ d_i(\Delta_j, \Delta_k)' = 0 \] if \( I_i \) indifferent to \( k \) & \( j \)

Then the purpose of MDS for this situation can be expressed as:

\[ \text{Max } \sum_{j \neq k} C_i(j,k) \cdot d_i(\Delta_j, \Delta_k)' \]

\[ \sum_{j \neq k} d_i(\Delta_j, \Delta_k) \]

This criteria sums those cases where the rank order and distance measure agree and reduces the numerator for cases that do not agree. Cases involving indifference are not considered. The denominator's purpose is to normalize the values. Other criteria are possible. J. Douglas Carroll, "Individual Differences and Multidimensional Scaling," in Shepard et al., Multidimensional Scaling, pp. 124-125.
it be monotonic, the techniques are described as nonmetric MDS.\(^49\) One of the benefits suggested by one of the developers of nonmetric MDS was that it is designed to achieve a metric solution on the basis of the very weakest possible assumptions about the original data. In particular, ... it makes no assumption about the analytic form of any function.\(^50\)

Another author has described metric methods as using ratio scaled input while nonmetric methods as using rank order input.\(^51\) Recent computer programs have tended to reduce this distinction. These programs are capable of doing either metric or nonmetric scaling on the same data. In addition, newer programs may use a combination of metric and nonmetric MDS to determine the points in an issue space. For example, KYST, a MDS computer program, can start by placing an initial configuration in a space according to a type of metric MDS and then apply nonmetric MDS to improve the configuration until an acceptable solution is found.\(^52\) Furthermore recent studies have shown that in many cases the solutions using metric and nonmetric algorithms are similar.\(^53\)


\(^{51}\) Green & Carmone, Multidimensional Scaling, pp. 33-35.


Accounting Policy Making & Dominance Data

Since the policy making body is ultimately concerned with individual preferences, dominance data must be collected. Two methods of collecting dominance data have been used extensively. One, called internal analysis, is based on preference data only. The other, called external analysis, is based on both proximity and dominance data. The decision on which data collection method is used depends upon their relative costs and benefits. By using only preference data which requires fewer questions, differences in perceptions may be compounded with differences in preferences. Furthermore, algorithms designed for use with dominance data allow the examination of the importance of issues to different individuals.\(^\text{54}\)

Under the external analysis method, the alternatives are placed in an issue space by using proximity data; subsequently a preference function is generated based upon the representation of the alternatives in the issue space by using dominance data. For internal analysis, the alternatives are placed in the issue space so as to conform to the individual's preferences.

Under multidimensional scaling, two types of preference functions have been usually considered. For one function, an individual's most preferred point in the issue space is located so that the distance between this point and all others approximates his preferences for the alternatives. The macro-like decision model is based upon this preference function. The other type of preference function assumes that individual's preferences can be represented by vectors from the origin. Preference is measured by the perpendicular distance from an alternative to the vector. The vector

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is located so that the distance between the vector and the alternatives approximates his stated preferences for the alternatives. In both cases, the greater the distance the less one prefers the alternative.55

**Description of the Issue Space**

Another decision concerns the representation of the issue space. An issue space for each individual can be presented and differences or similarities determined by examining each configuration. Another method is to restrict the individuals to one set of issues but allow them to weight each issue differently.56 In this case, $x_{ik}$, can represent the position of the kth object for $I_i$ as measured in his own issue space and can represent the position for the kth object in the group space. The result is $x_k = Z_i x_{ik}$, where $Z_i$ is a vector.

The ability to describe the issues which are determined is also of interest. Four considerations have been suggested for determining the dimensionality of the issue space:

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55 It has been shown that this assumption about preferences can be considered a special case of the former assumption. Carroll, *Individual Differences*, pp. 114-118.

56 Another possibility is to allow individuals to rotate axis to represent differences in issues. However, except in the Euclidean case different optimal solutions and preference locations may result. These weights are different from the weights discussed previously. The new weights represent the importance of an issue to an individual in making comparisons about the similarity of objects. The previous weights, $w_i$, represent the importance assigned to the preferences of interested individuals.
1. a measure of goodness of fit should be acceptable,
2. the representation of independent sets of data should approximate that of the original data,
3. the issues should be interpretable, and
4. the issue space should be readily visualizable.

The ability to interpret a meaning for each issue is important.

Two approaches have been used to describe the resulting issues. Since one method does not collect data on the reasons why individuals made their specific decisions, the other three considerations determine dimensionality of the issue space. The experimenter describes each issue after an examination of the output of the MDS program. Under the other approach, information is collected on the reasons why individuals made their specific decisions. Open ended questions are used to assist the experimenter in interpreting the dimensions. Detailed closed end questions are also used to provide input to regression equations.

Summary

Multidimensional scaling is a data representation technique that can provide the necessary individual preference information required by the macro-like decision model. MDS includes a large number of techniques with

\[ \sum_{i \neq j} (d(\hat{A}_i, \hat{A}_j) - d_{ij})^2 \]

where \( d_{ij} \) is a value chosen as close to \( d(x_i, x_j) \) as possible subject to it being monotone and \( d_{ij} = d_{ik} \) whenever \( C(i, j) = C(i, k) \). In the case of metric MDS \( d_{ij} \) would be chosen based on a linear or polynomial function.

the same general purpose. The specific techniques selected depends on
the information needs and the assumptions that one is willing to accept.

Decisions are made regarding the following MDS alternatives:

1. dominance data: external or internal analysis;
2. paired comparisons: ranking or rating;
3. algorithms: metric or nonmetric;
4. questions regarding how individuals made their
decisions;
5. computer program.

In most cases, the selection of an alternative for one through four
above will reduce the alternatives available for five. Decisions which
are common to most questionnaire investigations have not been considered.

These decisions and a further examination of the alternatives available
for MDS will be reviewed in the context of a proposed empirical investiga-
tion in Chapter IV Section II.
CHAPTER IV

Application of the Decision Model
(Conceptual and Proposed Empirical)

In the first two sections, a conceptual application of the decision model is presented, together with a proposed empirical investigation consistent with the model. The conceptual application examines the decision model and available information about its variables with previous accounting decision results. Several of the formulations provide results inconsistent with the available information about accounting policy making. Another formulation is introduced to allow multiple policy alternatives as the accounting policy. A method of comparing this formulation with the formulations developed previously is examined.

In the second section, an empirical investigation is proposed to examine some of the assumptions of the decision model and its conceptual application. The empirical investigation is concerned with a specific policy issue which has a number of policy alternatives. With the information provided by this application, further issues can be examined. In the context of this specific policy issue, a multidimensional scaling approach and the procedures used to generate the necessary information are developed.

In the final section, both the benefits and problems associated with the model are reviewed. Further empirical and conceptual extensions of the model are indicated.
Section I

The Decision Model: A Conceptual Application

This section examines the proposed formulations of the macro-like decision model for an accounting policy making situation. The examination will be consistent with the information developed in previous chapters. These situations are examined with respect to the existence and location of optimal policies. To examine the unconstrained formulations only two preferences, one to represent all suppliers and the other to represent all users, are considered in the issue space. To examine the constrained formulations, the assumption of all users being represented by a single user is relaxed. As a remedy to the problem of conflicting preferences among users, another formulation of the decision model is introduced. A method of comparing the desirability of a single or multiple policy alternatives being selected as an optimal policy is discussed. Finally, the model is expanded to take into account changes in individual preference.

Unconstrained Formulations

In accordance with Chapter II, suppliers of accounting information will provide only the minimum required by the SEC or FASB. Users prefer more information than suppliers would prefer to provide. For the unrestricted case, all users are represented by a single user, \( I_u \); all suppliers are represented by a single supplier, \( I_s \). Therefore, the two individuals are represented as shown in Figure 29. Since the FASB has an interest in the preferences of suppliers and users, it is most concerned only with the preferences of the users in the direction of the supplier's ideal point.
Both individuals are assumed to be represented by Euclidean norms. Therefore, their preferences can be represented as quarter circles from their ideal points (Figure 30).

The APB was accused of making policy decisions which favored suppliers. According to formulation (2) this would imply that $w_s > w_u$. This result is in apparent contradiction to the accounting literature which suggests that at least one group of users, unsophisticated investors, are of particular concern when accounting policy making bodies set policy. Since all users are combined, this suggests that users should be considered more important than suppliers, $w_u > w_s$. However, this concern for
unsophisticated investors may be ranked after an unstated concern for suppliers.

Formulation (3)

Consistent with the previous discussion, the individuals satisfactory regions for this situation are shown in Figure 31.

If users have objected to the decisions of accounting policy making bodies then under this formulation, the policy selected is outside of the users' satisfactory region, \( |\Delta x, x_u| > S_u \). From (3.1), the optimal policy must be in the satisfactory region of the suppliers, \( |\Delta x, x_s| < S_s \). This would result, according to (3.2), only when the weights of suppliers are greater than those of users, \( w_s > w_u \). This is the same result achieved by formulation (2) and once again, leads to an apparent contradiction.

Constrained Formulations

Upper and lower bound constraints for the policy decisions will be introduced as shown in Figure 32. The situation will now be expanded so that there are two groups of users, \( I_u1 \) and \( I_u2 \) and all users can be considered a member of either group. This could represent the distinction
Figure 32. Geometric Representation of the Constraints
between sophisticated and unsophisticated investors or investors and creditors as discussed previously. To present new situations, the unconstrained optimal solution will be outside the feasible region.

**Formulation (2c)**

The situation for the two investors and the supplier is shown in Figure 33. As discussed previously the location of the solution would depend upon the weights assigned to each group and the measure of loss used to represent each individual.

One interesting result can be obtained without considering specific variables. By having the constraints, the optimal solution is effectively giving the suppliers who are inside the constraint set a higher weight. Given the results of formulation (2c), an optimal solution for formulation (2) having the same results as formulation (2c) can only be obtained with higher weights on suppliers. Individuals may be viewing the problem of accounting policy making according to formulation (2), while the policy making body is faced with a problem indicated by formulation (2c). Therefore the users may feel a lack of consideration of their importance by the policy making body. Horngren suggests that this inability to
perceive the fundamental roles of accounting policy making bodies is very real.

The SEC has all the ultimate power, and the APB formulates principles subject to whatever constraints the SEC exerts. This point may be obvious to individuals who are well acquainted with APB activities, but it is not at all clear to many others.¹

Therefore, the FASB might want to indicate to the interested individuals the constraints it is operating under. The method of determining constraints will be extremely important in gaining individuals' acceptance of a change in their view of the accounting policy making process. For example constraints which the policy making body believes are imposed by suppliers probably will not result in a change in the individuals' view of this process.

**Formulation (3c)**

For this formulation, the satisfactory regions for the users will be outside the feasible region (Figure 34). The weights will be $w_{u1} > w_g > w_{u2}$.

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From (3c.2), the policy making body should select a policy such that \( ||x_s, \Delta^*|| \leq S_s\). Since there is only one individual in the feasible region, the solution does not depend on the relative weights given to suppliers and users. The constraints prohibit policies which the users would find acceptable.

In order for user preferences to count in determining the optimal policy, the policy making body must find a method to change the constraints or the users' preferences. Let it be possible for the constraints to be changed so that at least one point of the satisfactory region of \( I_{u1} \) and \( I_{u2} \) are included in the feasible region Figure 35. The optimal solution would now meet the criteria \( ||x_{u1}, \Delta^*|| \leq s_{u1} \). However, this policy is unacceptable to \( I_s \) and \( I_{u2} \). These individuals may join together in order to attempt

![Figure 35 Geometric Representation of the Changes of Individuals for Formulation (3c)](image)

to have the policy changed. If two of the groups together are considered more important than the third, a potentially unstable position is likely. The two groups whose preferred policy alternatives are not selected may be in a position to constantly attack the alternatives selected as the policy. This may require the policy making body to constantly reconsider policies previously accepted. Accounting policy making bodies may have been
required to frequently reconsider previously adopted policies because of this relationship between preferences and constraints.

The only ways to resolve this situation is to change individual preferences or provide for multiple policy alternatives as the optimal policy. Accounting has very little information regarding preferences of suppliers and users. Seemingly, the ability to change preferences is suspect.\(^2\) The use of multiple policy alternatives will be discussed in the next formulation. However, accounting has a long history of providing only one policy alternative as the optimal policy. If the FASB finds interested individuals in the situation just described accounting policies may be extremely difficult to determine.

**Policies Which Involve Multiple Alternatives**

An interesting approach to the situation considered previously is to include a number of policy alternatives in the policy selected. This is contrary to present practice but it does present a method of satisfying diverse interests. The importance of multiple alternatives has, however, started to be expressed in the accounting literature.

Complex problems require complex solutions. Clearly the accounting profession must start presenting multiple valuations and make multiple disclosures in their annual public reports...if the accounting profession is to comply with its ethical requirements to provide useful information.\(^3\)

\(^2\)The only way that the policy making body can change individual preferences is assumed through presenting information which the individuals perceive indicates that another alternative would be better.

By admitting the possibility of more than one alternative as the policy, formulation (3) and (3c) can be restructured to minimize the number of alternatives required to satisfy all groups. In this case the problem is:

\[ \text{Min } \sum_{j=1}^{m} \Delta_j \]

subject to \[ \sum_{j \in N_i} \Delta_j \geq 1 \quad i = (1, 2, \ldots, n) \]

\[ g_k(\Delta) \leq B_k \quad k = (1, 2, \ldots, r) \]

Since accounting policy making involves both suppliers and users, only one group can be satisfied. Suppliers providing one set of financial statements and users receiving different sets of financial statements appears inconceivable.

**Comparing Single and Multiple Policies**

The decision model allows a means of comparing single and multiple solutions by examining the values of the objective function for each formulation. Let the interested individuals be represented as shown in Figure 35 with weights \( w_{ul} > w_s > w_{u2} \). In selecting a single policy

4In location theory, this problem is referred to as the set covering problem which can be formulated as:

\[ \text{Min } \sum_{j=1}^{m} \Delta_j \]

subject to \[ \sum_{j \in N_i} \Delta_j \geq 1 \quad i = (1, 2, \ldots, n) \]

\[ \Delta_j = 0,1 \]

5For the unconstrained case, this problem can be formulated as:

\[ \text{Min } \sum_{j \geq 1} \Delta_j \]

subject to \[ \sum_{j \in N_i} \Delta_j \geq 1 \quad i = (1, 2, \ldots, n) \]
alternative, the policy making body would satisfy $I_{u1}$. The total loss from this action would be $w_g \| x_g, \Delta^* \| + w_u2 \| x_u2, \Delta^* \|$. Since there are two groups of users whose satisfactory regions are disjoint the optimal number of policies in order to satisfy them is two. Information would have to be obtained regarding how the suppliers view their losses in providing multiple alternatives to users in order to compute the loss for this situation.

Several methods of measuring suppliers losses appear possible. Two of these will be considered. In the first case the suppliers may view their losses as the sum of the distances from their most preferred point to each required alternative. For this case the loss is $w_g \| x_g, \Delta_{u1} \| + w_g \| x_g, \Delta_{u2} \|$.\(^6\) In the second case the suppliers may view their losses as equal to the distance between their most preferred position and one alternative selected and the distance between that alternative and all others selected. For this case the loss might be $w_g \| x_g, \Delta_{u1} \| + w_g \| x_g, \Delta_{u2} \|$.\(^7\) The loss will be assumed to be measured by the latter case.

The macro-like decision model provides a method of evaluating the type of policy alternative selected through the values of the objective functions for each formulation. The objective function can be used as a representation of the total loss for each alternative. For example, for the situation shown in Figure 35, if $w_g \| x_g, \Delta^* \| + w_u2 \| x_u2, \Delta^* \|$ for

\[^6\] $\Delta_{u1}$ and $\Delta_{u2}$ are selected such that $\| x_{u1}, \Delta_{u1} \| \leq S_{u1}$ and $\| x_{u2}, \Delta_{u2} \| \leq S_{u2}$. If their ideal points are selected then a problem with multiple solutions for formulation (2) is suggested.

\[^7\] For more than two alternatives, there are several different methods of measuring loss. How suppliers would actually measure loss must be empirically determined.
one alternative is greater than \( w_s \| x_s, \Delta u_1 \| + w_s \| \Delta u_2 \| \) for two
alternatives then a policy including two alternatives should be selected.
Alternatively, if \( w_s \| x_s, \Delta u_1 \| + w_s \| \Delta u_2 \| > w_s \| x_s, \Delta^* \| + w_{u2} \| x_{u2}, \Delta^* \| \), one alternative should be selected as the policy.

Inclusion of Additional User Groups

This problem has assumed that all users can be represented by two
groups. Given the discussion in Chapter II, this is highly unlikely.
Therefore, this assumption will be relaxed to allow users to be located
anywhere in the issue space. Given this situation, a large number of
alternatives may be included in the solution for formulation (4c). Due
to the costs of providing a large number of alternatives, the policy mak­
ing body may only want to examine alternatives found satisfactory to those
who meet a minimum level of importance. This can be included in the for­
mulations by adding the additional constraint:

\[
\sum_{j \in N_1} w_j \Delta_j \geq w'
\]

where \( w' \) is the minimum level of importance.
The inclusion of an alternative, \( \Delta_j \), may be the result of one individual
having a weight greater than \( w' \), a group of individuals having the same
satisfactory regions whose combined weights are greater than the minimum
level or a group having different ideal points but their satisfactory
regions intersect such that at some point or points \( \sum_{i=1}^{k} w_i \geq w' \). This
would allow the FASB to further reduce its search among policy alterna­
tives for the optimal policy.
Changes in Preferences

To this point, the macro-like decision model has been presented as a static model. However, one possible result of the receipt of information from a system is to change an individual's preferences for new information. Within a firm, a possible use of information has been to assist in determining what information will be used for future decisions. In financial accounting research on the efficient market hypothesis suggests that the individual investor "becomes a 'price taker' and acts as if the price is an unbiased assessment of the intrinsic value of the security."^9

In Chapter I, accounting policy making bodies were found to have had to reconsider previous policy decisions. A possible explanation for this situation was the failure of the accounting policy making bodies to consider interrelated policies. Another explanation presented in this section was the problem of different individual preferences with potential political pressure. A third explanation is the failure of the accounting policy making body to perceive changes in preferences. This explanation is supported in some of the comments regarding the APB's inability to act quickly to changing situations.

Selecting an optimal policy at one point in time will not guarantee that it is the best solution at some other time. One potential benefit of information discussed in Chapter II is to change the model or facets used by individuals. Seemingly preferences for information may change over time. If individual preferences change there is the possibility that

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the optimal policy alternative will change. In the case where \( w_i > \sum_{j \neq i} w_j \), if \( I_i \)'s preferences change, the optimal policy should change to \( I_i \)'s new most preferred position. This situation is illustrated in Figure 36. If the policy is not changed the previously selected policy is a nonoptimal one.

![Figure 36 Geometric Representation of Changes in Preference Over Time](image)

The change in the optimal policy would depend upon the changes in individual preferences and any changes in weights that might occur. Although the exact change would be the result of a specific set of changes in these two variables, several interesting questions are raised by the inclusion of the changes. If individuals are allowed to change their preferences over time, when should policies be reexamined to determine whether the policy is still the optimal one. Also, how often can the policy making body reconsider the same policy issue without incurring a loss of confidence among suppliers or users. The FASB needs timely ways to indicate when policies should be reconsidered before being subjected to extreme pressure for change. The macro-like decision model can provide insight into this problem.
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UNIVERSITY MICROFILMS
set of financial statements are prepared for each valuation method.\textsuperscript{13}

Table 18 Alternative Accounting Valuation Methods

1. Discounted future cash receipts or service potentials
2. Current output values
3. Current cash equivalents
4. Liquidation values
5. Discounted future flows
6. Current input costs
7. Historical costs
8. Price level adjusted historical costs
9. Lower of historical cost or market value.

Financial statements have been considered which present different valuation alternatives for the same item. Under this approach, long-lived assets might be valued under both their historical cost and price-level adjusted historical cost. Another approach would have different items in the financial statements valued according to different valuation alternatives. For example, raw materials might be valued according to their current input costs and long-lived assets according to their estimated discounted future service potentials. The number of possible policy alternatives for valuation methods is extensive. However, on an a priori basis, accounting literature tends to support certain valuation alternatives over others. The accounting literature has consistently advocated three valuation methods, historical cost, price-level adjusted historical cost and replacement cost. In a recent publication, the FASB

noted that "hundreds of articles and a number of books and research studies have been written on the subject." The alternatives to be presented for these three methods are shown in Table 19.

Table 19 Valuation Alternatives to Be Presented in Financial Statements

1. Historical cost
2. Replacement cost
3. Price-level adjusted historical cost
4. Historical cost with footnote information regarding price-level adjusted historical cost for long-lived assets.
5. Historical cost with footnote information regarding price-level adjusted historical cost for long-lived assets and earnings.
6. Historical cost and price-level adjusted historical cost.
7. Historical Cost with footnote information regarding replacement cost for long-lived assets.
8. Historical cost with footnote information regarding replacement cost for long-lived assets and earnings.
9. Historical cost and replacement cost.

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Figure 37 presents a relationship between the statements.

**Statements Based on**

**Single Policy Alternative**
- Replacement Cost
- Historical Cost
- Price-Level Adjusted

**Single Policy Alternative with Footnote Disclosure**
- $\#7$

**Single Policy Alternative with Additional Footnote Disclosure**
- $\#8$
- $\#5$

**Two Policy Alternatives**
- $\#9$
- $\#4$
- $\#6$

![Diagram of Figure 37 Relationship Among Financial Statements To Be Presented for Comparison](image)

Nine alternatives are selected because of the data requirements of MDS. If $n$ different alternatives are to be presented to an individual, $n(n-1)/2$ paired comparisons will be required. At least nine different alternatives should be presented for comparison. For nine alternatives an individual is required to make thirty-six comparisons. Care must be taken so the number of questions asked does not discourage individuals from returning the questionnaires. For these reasons, only nine accounting valuation alternatives will be compared.

Previously, at least one other policy issue, accounting for business

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15 Kruskal, Young & Seery, *How to Use KYST*, p. 35. This required number of alternatives for comparison was determined for a computer program different from the one selected for analysis of the data generated by this questionnaire. However, this minimum number is applied to many MDS computer programs.
combinations, was suggested as being related to the valuation issue.

With the information currently available regarding individuals' preferences, the data requirements of MDS make it difficult to consider these two issues jointly. As a minimum, two policy alternatives (purchase and pooling) would have to be considered for accounting for business combinations. This would involve individuals making 153 paid comparisons for the eighteen alternatives. Therefore, only the nine valuation alternatives will be presented.

**MDS and the Questionnaire**

The lack of information regarding individual preferences makes it desirable to collect both similarity and preference data. This allows the examination of the importance of an issue to different individuals. The diverse nature of the interested individuals makes it desirable to collect information on the importance of issues in similarity and preference situations. Furthermore differences in perception are less likely to be confounded with differences in preferences.

Two MDS computer programs are appropriate for the analysis of the responses to the questionnaire. One called INDSCAL (Individual Difference Scaling), can analyze individual and group proximity data. The

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16 Business Combinations accounted for by the purchase method result in the revaluation of the assets of the purchased firm. Those business combinations accounted for by the pooling method consider that the interests of both firms continue in the combined one. No revaluation of assets results in this situation. For a discussion of these two alternatives see "A.P.B. Opinion No. 16 - Business Combinations" as reprinted in Accounting Principles Board, APB Accounting Principles, p. 6640.

17 In an additional questionnaire those general valuation alternatives considered most preferred in this investigation can be combined with the alternatives for the valuation of business combinations to present a new set of alternatives to subjects.
ability to present aggregated and disaggregated proximity data is desirable since the proposed empirical investigation is concerned with users' and suppliers' evaluations of financial statements. INDSCAL generates a group issue space for all individuals; individual issues spaces are determined by allowing different weights on each issue for each individual. INDSCAL provides an indication of how well an individual can be represented by the group space.  

The issues determined by INDSCAL cannot be transformed, by rotation of axis for example, without changing the solution. Carroll and Wish believe that

psychologically this means that INDSCAL dimensions correspond to 'fundamental' physiological, perceptual or conceptual processes whose strength...may differ from individual to individual...  

The number of issues are determined to provide a best goodness of fit.

The other computer program, PREFMAP, analyzes proximity MDS results and individual preference data to provide dominance MDS information. For the given input, an ideal point is found for each individual in the issue space so that the distance from the ideal point to the alternative points approximates as close as possible his stated preferences. Weights to indicate the importance of each issue to an individual are provided.

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20J. J. Chang and J. D. Carroll, How to Use PREFMAP and PREFMAP2 - Programs which Relate Preference Data to Multidimensional Scaling Solution, Unpublished, Bell Laboratories, Murray Hill, N. Y., undated, pp. 1-3. PREFMAP can also scale preferences according to a vector model.
21This presents a third potential weighting, for individuals' reasons for preferring certain alternatives may have different weights from the differences among alternatives.
Subjects

Suppliers will be represented by those who have a high position in the accounting and finance departments of firms whose stock is publically held. These individuals are to be selected because of their knowledge of accounting and the costs of providing accounting information. These individuals are in close proximity to the decision making regarding the inclusion of information in financial statements.

In order to consider the differences between suppliers and users, only sophisticated investors will be included. They are selected because of their knowledge about accounting and their implied ability to use accounting information. Because of the lack of a precise definition of sophisticated investors to differentiate among all investors, members of the Financial Analysts Federation will be used to represent sophisticated investors.

The Questionnaire

In addition to a cover letter, the questionnaire will consist of four types of questions on:

1. the subjects background and position,
2. similarities among financial statements,
3. preferences among financial statements,
4. the issues used by the subjects in making decisions.

In eliciting information about the subject's position and experience in investing or management, he will be asked his age, education level, title of position in firm, and years with firm. In addition, questions regarding his personal investments will be included to recognize the possibility that individuals who have control over a firm's financial reporting may
also do substantial investing on their own. These questions will seek information regarding the number of different firms in and the estimated market value of his portfolio.

While the comparison based upon actual financial statements is desirable, the size of the questionnaire including the statements might discourage subjects from responding. Since the two groups being considered have knowledge of accounting, the types of policy alternatives could be compared by using their names. However, this might affect the subjects' answers regarding the issues used in making his decisions. Research on the effects of using names of alternatives rather than the alternatives themselves is lacking. In one study, the preferences of individuals did not differ between the names and photographs of automobiles as the alternatives presented. Issues were found to be "luxuriousness" and "sportiness," not the brand names of the automobiles. However, for the case involving accounting policy alternatives, the issues that subjects may be using are the quantity of information which would be indicated in the name. Seemingly, actual financial statements are the more desirable method of presenting the alternatives to the subjects.

Financial statements using the alternatives indicated in Table 18 will be prepared. Nine sets of financial statements, numbered one through nine, will be presented to the subjects. They will be asked to rate the similarity of each pair of statements regarding the decisions required by their job. This part of the questionnaire can be presented as shown in Figure 38.

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Listed below are pairs of financial statements which you have just examined. Please indicate your personal judgment with respect to your employment situation on how different one statement is from another for the decisions you make about other firms (your firms) financial statements.

<table>
<thead>
<tr>
<th></th>
<th>Very Different</th>
<th>Very Similar</th>
</tr>
</thead>
<tbody>
<tr>
<td>#2/</td>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>#5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 38 A Part of the Questionnaire

Once information on similarities is obtained, questions designed to elicit information about the issues can be considered. Typically two types of questions have been used to gain information about the description of each issue. One is the open ended question which asks the individual to state why he made a particular decision. The other type uses questions which ask individuals to rate their choices on the basis of specific criteria. Both methods require the judgment of the individual collecting the information in describing each issue. The latter method may include statistical techniques, such as regression analysis, to determine the description of each issue. However this method may force individuals to rate their selections on criteria that are not normally used in selecting alternatives.

For this empirical investigation a combination of the two approaches appears desirable. Several open ended questions can be asked regarding the selection of specific alternatives. For example the following question can be used to elicit this information:
In comparing Financial Statement #2 with Financial Statement #5 you rated them on a scale of similarity from 1 to 9 as _____. What factors did you use in making this decision?

For the questions requiring individuals to rate alternatives on specific criteria, the accounting literature can provide the necessary criteria. Since the purpose of accounting is to provide useful information, individuals might evaluate statements on the basis of their usefulness. The accounting literature has suggested that certain other criteria are used to evaluate the usefulness of financial statements. Therefore, both the criterion of usefulness and the criteria used to evaluate the usefulness of financial statements will be included in the questionnaire.

In an empirical study of the criteria suggested by the Trueblood Committee, six of the seven could be placed into three groups:

- most important: relevance and understandability,
- in between: comparability and verifiability,
- least important: neutrality and timeliness.

Those criteria considered least important will be omitted from consideration. Also omitted, because of the subjects included, will be

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24 John Cumming, Acquainting Students With Empirical Research in Accounting, Unpublished Paper, University of Minnesota, 1975. Completeness was found too redundant to evaluate.
understandability. Since these criteria are user oriented, supplier criteria must be included. Considering the previous discussion, cost and feasibility will be included as supplier criteria. Therefore, the subjects will be asked to rate the alternatives on the criteria of:

1. usefulness
2. relevance
3. comparability
4. verifiability
5. cost
6. feasibility

The responses to these two types of questions will allow a comparison of the criteria suggested in the accounting literature with those which individuals use.

Next the subjects will be asked to rank the financial statements in order of preference. A question can be:

Please rank the financial statements in order of your preference (1 being the most preferred and 9 being the least preferred) in the context of making investment decisions (or for suppliers: providing accounting information to those who make investment decisions).

Finally a question to determine whether a level of satisfactory financial reporting for individuals exists will be included. This question can be:

Considering that you may not be able to receive (provide) your most preferred financial statements,

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25Consistent with the definition used by Anthony, feasibility means that the value to the firm must exceed the cost to the firm of supplying the information in "Research," p. 260.
which statements would you be satisfied with if provided to (supplied by) you.

Summary

The questionnaire is designed to elicit information for use in the MDS programs previously considered. The effects of the length of the questionnaire on subjects' responses may require changes in some of the questions.

With the results of this empirical investigation, several questions raised by the decision model can be examined. These relate to the formulations and assumptions of the decision model. For example, one concerns whether individual preferences for accounting information can be represented as suggested by the model. The results of one empirical investigation will not be conclusive. However, this empirical investigation presents a starting point on which successive investigations can be based.

Section III

Summary and Extensions of the Decision Model

A decision model consistent with the stated accounting policy making goal of providing useful information has been developed. The model was compared to other approaches to accounting policy making and found superior. Elements of the model were examined descriptively and prescriptively. Previous methods of setting weights were examined in order to suggest possible methods that might be used in the future. MDS was suggested as a method of determining individual preferences.

The decision model is based on spatial analysis. Spatial analysis
allows a mathematical programming formulation of the objective and constraints of accounting policy making. The theorems and knowledge obtained from mathematical programming for constrained cases and location theory for the unconstrained cases were used to provide insight into the problem of an optimal accounting policy. Several formulations of the decision model based upon different types of individual preferences and accounting policy making objectives were developed. When these formulations were compared using an abstract issue space but with preferences and weights consistent with available information, the results for most formulations did not appear consistent with the results of past accounting policy decisions. One formulation shown to be consistent with past policy decisions presented serious problems to the accounting policy making body when attempts were made to satisfy more individuals.

Benefits of the Model

A model of the complex situation of accounting policy making has been developed. The model has two primary benefits to accounting. The first is to examine the fundamental relationships between accounting and its environment. The second is to provide a model upon which to build empirical research. Each of these benefits will be examined.

Private sector accounting policy making needs a careful analysis of its environment in order to survive. As Ijiri indicates:
accounting cannot move ahead without first considering the organizational, legal, and economic environment because the interests of many people, organizations, and governments are intricately meshed with the accounting process.\textsuperscript{26}

The model provides a method of examining the complex relationships among important variables through a less complicated approach. This approach allows the accounting policy decision process to be examined in a different way by the presentation of abstract variables in a geometric space. Thus problems of accounting policy makers caused by the relationship among the important variables can be visually recognized and alternative solutions examined. Therefore, the policy making body should be in a position to more easily determine the underlying problem rather than symptoms of a problem. For example, the model suggests three possible explanations for the fact that accounting policy makers have consistently needed to reconsider previously selected policies. In addition the model suggests a method of determining when a policy involving multiple alternatives is more desirable than a single alternative.

The model suggests that accounting policy makers need a greater amount of information about the variables included in the model. In order to be more certain that acceptable decisions are made more information about individuals' preferences and methods of assigning weights to specific individuals are needed. The model highlights those areas in which empirical information and more concrete instructions are needed.

Much of the past empirical research provides little insight into these important areas. Therefore, the model indicates directions for future research.

The model provides these benefits by making certain assumptions regarding the important variables. The available information about these variables is consistent with the assumptions required for the approach. The approach focuses on these important variables and examines systematically the relationship between these variables and policy alternatives. This decision model follows other models in that

ey are idealized in the sense that they are less complicated than reality and hence easier to use for research purposes... The simplicity of models, compared with reality lies in the fact that only relevant properties of reality are represented.27

The systematic approach of this model is a striking contrast to the previous approaches to accounting policy making. These previous approaches have met with serious challenges. Therefore, this approach appears a more fruitful way to examine the important relationships in accounting policy making.

The importance of providing a model upon which to build empirical research, the second benefit, must not be understated. Anton, in a critical synthesis of a conference on empirical research in accounting, concluded

if we are going to do empirical research, we have to have a model preceding it, and that model itself has to be well tested and consistent. I looked for that in the papers and found it singularly lacking.28

The importance of models is emphasized by the scientific principle that one can never prove anything by observation. Scientific progress is made when the results of empirical observations are examined against conceptual observations from established models.29

Accounting has a long history of model building and a rather brief history of empirical research. Unfortunately, not much of the empirical research has been directed at testing of these models.30 However, changes in the accounting environment may have made most of these models obsolete, for a large number of them were based on the "historical communication" approach, which has been unacceptable for the present environment.31 In an examination of the empirical accounting research of the 1960's, Hakansson felt:

the model building areas is presently the Achilles heel of empirical research in accounting. It is not only the most difficult area but also the most challenging.32

29 Ibid, p. 166.
In his examination, Hakansson concluded

"I suspect that the days when a Ph.D. candidate will be able to more or less pick a hypothesis "out of the air" and perform a test...are disappearing. Instead, I would expect the serious empirical researcher of the future to devote his thesis and perhaps considerable efforts beyond that mainly to the development of hypothesis which are suitable for testing."^33

The purpose of this model is consistent with previous accounting research for "we have worried and worry more about what accountants and accounting should do rather than what they do do."^34 The decision model provides some interesting insights into the problems of accounting policy determination. The decision model indicates that additional information is needed about:

1. Interested individuals'
   a. methods of determining preference
   b. current preferences
   c. perceptions of relations among accounting policy issues.

2. Policy making body's
   a. best method to determine the importance (weights) of interested individuals
   b. constraints imposed by other organizations
   c. goal

Several formulations of the objective function have been introduced to account for differences in individual preferences and objectives of the accounting policy making body. Other formulations consistent with the

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^33Ibid, p. 166.
^34Ibid, p. 141.
stated goal of the accounting policy making body are possible. Another formulation consistent with the goal of accounting might be to minimize the maximum loss of all interested individuals. The formulations presented previously appear consistent with available information. For individual preferences, empirical information is necessary to select among alternative formulations of the objective function.

Restrictions on optimal solutions have been introduced through linear constraints. However, the model is not restricted to just linear constraints. Seemingly, many decisions do involve linear constraints or constraints that can be approximated by linear ones. Once again, information regarding the restrictions on the FASB in selecting among alternative policies is lacking. This same situation is also evident when considering the relative importance of individuals.

**Application of the Model**

The model proposes an integrated method of setting accounting policy. The model requires information regarding how interested individuals make preference decisions on accounting policy alternatives. The model suggests that policy issues considered interrelated should be examined together. Once this information has been provided the model requires a maximum of two information sources. One source must indicate individuals' preferences. Another may supply weights for each individual. As discussed previously, only individual preferences may be required. The preference information requires both the individual's most preferred position, the \( x_i \)'s, and each individual's measure of loss, the \( d_i(x_i, \cdot) \)'s.

After this information is provided, the decision model can supply two types of aggregated information to the FASB. First, the optimal
accounting policy, $\Delta^*$, is indicated. Second, the value of the objective function for the optimal policy alternative can be presented. This value can provide information on the difference of opinion among interested individuals. In the case where all individuals agree on the same alternative as their most preferred, the value of the objective function would be zero. Positive values of the objective function indicate differences of opinion among individuals on their most preferred alternative. For higher values of the objective function, which indicates a large amount of disagreement among individuals, the policy making body may want to take action to reduce this disagreement. This might be accomplished through:

1. a change in the constraint set
2. adopting a policy which provides for reporting a number of alternatives
3. methods to encourage change in individual preferences.

The use of the model will provide one further benefit to the interested individuals. The decision model will allow an easier audit of the FASB's policy decisions in regard to their stated goal. Figure 39 presents a summary of the proposed procedure using the decision model.

![Diagram](Figure 39 Use of the Decision Model by the FASB)
Multidimensional Scaling and the Decision Model

MDS has been suggested as the method of providing information regarding individuals' preferences to the decision model. MDS can also provide insight into the issues used by interested individuals in making their preference decisions. MDS can also provide information regarding the interrelationship among accounting policy issues. For this information to be provided, several empirical investigations will be needed. The procedure necessary to generate this information requires lengthy questionnaires. The information generated by MDS may be subject to alternative interpretations. For example, the descriptions of each issue may be difficult to determine.

Limitations of the Model

Both MDS and the decision model make certain simplifying assumptions in order to present an interesting formulation. Some of the assumptions are subject to empirical tests. Among these assumptions are ones that relate to the representation of an individual by a point in a metric space and by a trade-off between issues. Another difficulty is the representation of certain issues in a continuous space. If the issues in the space are represented by policy alternatives, it may be difficult to present certain policy issues in the space because of their discrete nature.

MDS assumes that all individuals' preferences can be represented by the same metrics. Although the Euclidean metric has received most of the attention in MDS studies, current computer programs are capable of allowing individuals to be represented by the City Block or Sup metrics. Some programs do allow different weights for a fixed set of issues by each
individual. However, a readily defensible criterion for deciding which metric to use is not available. The selection of a specific metric may require the examination of a potentially large number of distance measures that can be used in place of the three metrics considered. It may be difficult to apply the decision model to determine an exact optimal solution if individuals use different metrics.

Optimal solutions determined by the decision model may be difficult to interpret if the solution is not close to a combination of policy alternatives that was used in the elicitation of individuals' preferences. This is especially important if the issues represent the criteria suggested by the accounting literature for selecting among policy alternatives.

In the theoretical application of the decision model, the issues were represented by a quantity of certain information. The ability to aggregate over individuals may be difficult if the individuals select among policy alternatives on the basis of abstract criteria like that suggested in the accounting literature. For example, let $I_8$ and $I_{11}$ be capable of being represented by a spatial analysis. Their decisions regarding alternative financial statements are made on the basis of perceived usefulness and feasibility of obtaining certain statements. Due to their different situations, both usefulness and feasibility may have different meanings to each individual. Possibly, their issue spaces may be so different that an aggregation over users and suppliers is meaningless.

**Extensions of the Model for Private Sector Accounting Policy Making**

The lack of information about the variables included in the decision
model may be the result of prior methods used to determine accounting policy. The "historical communication" approach suppressed the variables which were included in the decision model. While including the variables that appear important, the assumptions made in including these variables may be considered too simple. Some of the assumptions can be enriched. Three examples of more complex assumptions will be presented. Individual preferences have assumed no external effects. Possibly one user's preferences may in part be based on the preferences of others. In addition, individual preferences can be expanded to include the possibility of several levels of acceptance rather than the two level approach presented. Finally, the dynamic nature of individual preferences and accounting policy making can be incorporated into the model. The question of which policy or set of policies should be considered at a certain time can be examined.

Extension of the Model to Public Sector Accounting Policy Making

The decision model has been developed considering its use by private sector accounting policy making bodies. The goal of the SEC as stated in the Securities Acts makes the same decision model approach applicable to their policy making situation. The SEC, however, has broader authority than just accounting policy. In addition to the Securities Act of 1933 and the Securities Exchange Act of 1934, the SEC has authority derived from other acts including the Public Utility Holding Company Act of 1935. These acts give the SEC authority over areas not considered part of accounting policy making. Among these additional powers are the requirements of:
1. registration of
   a. certain securities before a public offering,
   b. all securities listed on stock exchanges,
   c. certain dealers in securities,

2. regulation of
   a. the stock exchanges,
   b. certain types of credit and borrowings.

Seemingly the SEC may have more issues of importance to more interested individuals. Furthermore, its expanded authority may cause individuals to be weighted differently than for the FASB.

The constraints on the policies selected by the SEC may also be different from those of the FASB. For the FASB, one source of possible constraints on policy decisions was the SEC. These constraints are not faced by the SEC. However, Congress may be providing constraints on actions by the SEC.

By examining the formulation of the decision model for the SEC, insights may be obtained for some of the policy making problems of the FASB. For example, the weights assigned to interested individuals may be so different between the two organizations that conflict between the FASB and SEC is bound to develop. If unsophisticated investors are regarded as the most important group by the FASB and sophisticated investors are regarded as the most important group by the SEC, differences in policies adopted probably can be expected. In this case the FASB might want to reconsider its weighting procedure. Furthermore, providing information about the variables in the decision model for the SEC, allows outsiders to determine with greater ease whether the SEC is meeting the
the objectives assigned to it in the Securities Acts.

Extensions of the Model to Managerial Accounting Problems

The decision model has been formulated and applied to financial accounting. The decision model can also be appropriate for managerial accounting. For this case, let the issues represent the goals of a firm. A multidimensional representation is appropriate because firms usually have multiple goals. Furthermore the preferences of different individuals or groups of individuals may be more important than others. A specific example of a managerial accounting problem that can be examined using the decision model approach is the transfer pricing problem.

A transfer pricing measures the effects of intrafirm transactions when a profit center buys its inputs from or sells its outputs to another profit center within the firm.

The use of decentralized organization structures in business has required the development of accounting methods to evaluate internal segments of a firm. Transfer pricing is a method which has received considerable attention as a means of assisting in the evaluation of

segments of a firm. This attention has been maintained in the recent literature.

The methods used to determine a transfer price can be divided into four groups:

1. economic theory
2. mathematical programming
3. other analytic methods
4. situation specific methods.

None of the methods available appear to be superior to the others. For example, mathematical programming while producing a transfer price which

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37 Among these articles are:

38 Among recent works are:

is best for the firm as a whole has been attacked because of possible adverse effects on morale. After a review of available methods, two authors have concluded

Even though transfer prices may be determined by rather sophisticated techniques, they are often followed by negotiation and/or directives specified by headquarters.40

Seemingly a compromise between issues is required. Furthermore, the transfer price selected may have different affects on different individuals within the firm. For example, a higher transfer price may benefit the supplying unit and a lower transfer price may benefit the using unit. The transfer price selected may also have an affect on the profit of the firm. Furthermore the firm as an

...organization is itself composed of many groups and individuals. And any decision that is taken will be more consonant with the wishes and goals of some of these groups and individuals than with others. So the decision is apt to be mediated not only by the logic of the situation...but also by some issues of power and some ideas about justice.41

The decision model approach can be used to assist in determining a best transfer price considering different individuals and issues. Some firms may weight individuals and issues differently than other firms weight them. For example, profit maximizing firms may weight the issue of income to the firm more than the morale of certain members of management.

41Leavitt, Managerial Psychology, p. 280.
Summary

The approach developed for accounting policy making by private sector organizations can be applied to other accounting-oriented problems. It can provide insights into problems faced by such diverse groups as the SEC and management of a firm. These wider applications result from the fact that these decisions typically involve a number of issues. Seemingly, the approach can be expanded to any decision which involves a number of interrelated issues.
APPENDIX A: Mathematical Representation of Distance

This appendix is presented to provide a brief introduction to the mathematical procedures used in location theory including norms and metrics. According to Kuhn, location theory has as its predecessor "one of the oldest organization problems in mathematics." ¹

Physical Space Analysis

If one requires the determination of the minimum cost location for a firm's distribution center, given the location if its two stores, a cartesian coordinate system can be developed using one of the stores as the origin. It will be assumed that both stores will receive equal amounts of merchandise and the shipping costs are a linear function of the distance traveled. This problem is shown graphically in Figure 40.

![Figure 40: Geometric Representation of a Physical Distribution Problem](image)

If the company desires to minimize shipping costs, the decision model is

$$\text{Min } \sum_{i=1}^{n} w_i \left[ (x_1 - y_{1i})^2 + (x_2 - y_{2i})^2 \right]^{1/2}$$

where:

- $n$ is the number of markets (stores).
- $(y_{11}, y_{21})$ is the location of the $i$th market (stores).
- $w_i$ is the unit distance cost of shipping from the distribution center to the $i$th market.
- $(x_1, x_2)$ is the location of the distribution center.

In this example if $w_1 = w_2 = 5/2$ then $n = 2$, $(y_{11}, y_{21}) = (0, 0)$, $(y_{12}, y_{22}) = (3, 4)$ and $(x_1, x_2) = (3/2, 2)$. For certain distribution situations the firms are constrained because it is impossible to use straight line distances. In most cities to get to another location one must follow streets which tend to be perpendicular and parallel to each other. For example consider a distribution center for stores located at $(0,0)$ and $(2,4)$ in a city. This problem is typically faced when determining the location of emergency facilities for municipalities. In this case, Euclidean distance has no practical application. Feasible routes are shown graphically in Figure 41.

![Feasible Routes](image)

**Figure 41** Feasible Routes for Distances in a City

The location decision model can be stated more generally as

$$\text{Min } \sum_{i=1}^{n} w_i d(x, y_i)$$

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where \( n \) is the number of markets
\( x \) is the point indicating the location of the distribution center
\( y_i \) is the point indicating the \( i^{th} \) destination of the product
\( d(x,y_i) \) is the distance from \( x \) to \( y_i \) such that \( d(x,y_i) \geq 0 \)

Two Specific Classifications of Distance Functions

Due to similar properties, certain distance functions are grouped together. Two types of these distance functions, norms and metrics, will be considered. If the \( d(x,y_i) \) has the following four properties, it is a metric and the space is considered a metric space: First, the distance between two points is equal to zero only when the two points are the same. Second, when the two points are not the same the measure of distance is a positive number. Third, the measure of distance between two points is unaffected by measuring from \( x \) to \( y \) or \( y \) to \( x \). Finally, the distance between two points is less than or equal to the distance between the two points as measured from a third point. This last property is frequently referred to as the triangle inequality. The four properties can be summarized as:

1. \( d(x, y) = 0 \) if and only if \( x = y \)
2. \( d(x, y) > 0 \) if \( x \neq y \)
3. \( d(x, y) = d(y, x) \)
4. \( d(x, y) \leq d(x, z) + d(z, y) \) where \( z \) is in the space

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In contrast, a norm is defined as a real-valued function, $|| \cdot ||$, in a vector space which has the following properties for all vectors $a$ and $b$.

1. $|| a || > 0$
2. $|| a || = 0$ if and only if $a = 0$
3. $|| \lambda a || = \lambda || a ||$ where $\lambda$ is any scalar
4. $|| a - b || \leq || a || + || b ||$

Given a vector space we can define a distance function $d(a, b) = || a - b ||$ which is a metric because

1. $d(a, b) \geq 0 \iff || a - b || \geq 0$
2. $d(a, b) = 0 \iff || a - b || = 0 \iff a - b = 0 \iff a = b$
3. $d(a, b) = || a - b || = \frac{1}{2} (|| a - b || + || b - a ||) = d(b, a)$
4. $d(a, c) = || a - c || = || a + b - b + c || < || a - b || + || b - c || = d(a, b) + d(a, c)\quad ^4$

Therefore one can think of a norm as being a metric. However a metric is not necessarily a norm. If a metric satisfied the equivalent of property three for a norm and $d(a + z, b + z) = d(a, b)$, then it is equivalent to a norm.$^5$ In particular metric $d(a, b)$ is equivalent to the norm $|| a - b ||$.

Metrics in Location Theory

In order to ease the requirements for a solution to two dimensional problems, several metrics have been developed. These are the Euclidean, the City Block and the Tchebycheff (or Sup) metrics.$^6$ In the metrics

$^4$Singer and Thrope, Lecture Notes, p. 37.
$^5$Wendell & Thorson, "Dictatorship," p. 12
$^6$ These metrics are considered because of their interesting application in spatial analysis.
In literature, these are special cases of the P metric. The P metric is defined as

\[ d(x, y) = \left[ \frac{1}{P} \sum_{i=1}^{P} |x_i - y_i|^P \right]^{1/P} \]

where \( x_i = (x_1 \ldots x_n) \) and \( y_i = (y_1 \ldots y_n) \).

Before considering each of the metrics, one additional concept will be introduced. \( d(x, a) < r \) is defined as a ball of radius \( r \) about a fixed point. Points which meet criteria \( d(x, a) = r \) are said to be equidistant from the fixed point.

The Euclidean metric was utilized in the problem of determining the distribution point for the stores at locations (0,0) and (3,4). The problem can be expanded from a two dimensional to an N dimensional one. In an N dimensional space the distance function is

\[ d(x, y) = \left[ \sum_{i=1}^{N} (x_i - y_i)^2 \right]^{1/2}. \]

Notice the similarity to the P metric when \( P = 2 \) for \( |x_i - y_i|^2 = (x_i - y_i)^2 \).

Therefore, \( \left[ \frac{1}{P} \sum_{i=1}^{P} |x_i - y_i|^2 \right]^{1/2} = \frac{1}{P} \left[ \sum_{i=1}^{N} (x_i - y_i)^2 \right]^{1/2} \).

Finally, a graphical representation of a ball of radius \( r \) about a fixed point, \( a \), for a Euclidean metric will be considered. Let the fixed point, \( a \), be the origin, and \( r \) equal to one. On the axes the points of intersection are (1,0), (-1,0), (0,1) and (0,-1). To prove that these points meet the criteria, one can substitute into \( d(x, y) \):

\[ (x_1 - 0)^2 + (x_2 - 0)^2 = 1 \] \( \left[ (-.6 - 0)^2 + (-.8 - 0)^2 \right]^{1/2} = 1 \]

Another set of points is (.6, .8), (-.6, .8), (.6, -.8) and (-.6, -.8). By determining other points which meet the criteria the graph would eventually

---

7In this section "n" represents the number of dimensions in the space.

8Letting \( y = (0, 0) \),

9Notice that \( \left[ (.6 - 0)^2 + (.8 - 0)^2 \right]^{1/2} = \left[ (-.6 - 0)^2 + (-.8 - 0)^2 \right]^{1/2} = 1 \)
appear to be a circle (Figure 42).

\[ d(x, 0) = 1. \]

Figure 42 Graph of a Ball of Radius 1 About the Origin for a Euclidean Metric

Given a perpendicular and parallel transportation system, the problem of locating a distribution facility can be solved by using the City Block metric. The distance between two points is the sum of the absolute value of the distance on each of the axes. The distance between the points \((0,0)\) and \((3,4)\) is

\[ d(x, y) = |x_1 - y_1| + |x_2 - y_2| = |0 - 3| + |0 - 4| = 3 + 4 = 7. \]

For an \(N\) dimensional space, the distance formula is

\[ d(x, y) = \sum_{i=1}^{n} |x_i - y_i|. \]

This is equivalent to the \(P\) metric with \(P = 1\) for

\[ d(x, y) = \left[ \sum_{i=1}^{n} |x_i - y_i|^1 \right]^{\frac{1}{1}} = \sum_{i=1}^{n} |x_i - y_i|. \]

For the graphical representation, the fixed point once again will be the origin and the radius equal to one. On the axes the points of intersection are \((1,0)\), \((-1,0)\) \((0,1)\) and \((0,-1)\). Another set of points is \((.5,.5)\), \((- .5,.5)\), \((.5,-.5)\) and \((- .5,-.5)\).\(^{10}\) Furthermore the point \((.6,.8)\) used to graph the Euclidean metric does not meet the required distance for the City Block metric \[ |0 - .6| + |0 - .8| = 1.4 \neq 1 \]. By locating other

\[ 10\]

\[ |.5 - 0| + |.5 - 0| = |-.5 - 0| + |-.5 - 0| = |.5 - 0| + |-.5 - 0| = 1. \]
points the graph would eventually appear as a diamond shape (Figure 43).

\[
d(x, 0) = 1.
\]

\[
\begin{array}{c}
(0, 1) \\
(-1, 0) \\
(1, 0) \\
(0, -1)
\end{array}
\]

Figure 43 Graph of a Ball for a City Block Metric

So the "ball" in this case is a diamond shape.

The Tchebycheff (Sup) metric sets the distance as the maximum of the distances on each of the axes. Using the previous example the distance between the points (0,0) and (3,4) is

\[
d(x, y) = \max \{ |x_1 - y_1|, |x_2 - y_2| \} = \\
\max \{ |0 - 3|, |0 - 4| \} = \max \{ 3, 4 \} = 4
\]

For an N dimensional space the formula is

\[
d(x, y) = \max_{j=1, \ldots, n} |x_j - y_j|.
\]

This is equivalent to the \(P\) metric with \(p = \infty\).

For

\[
d(x, y) = \left[ \prod_{i=1}^{n} |x_i - y_i|^\frac{1}{\infty} \right]^{\frac{1}{\infty}}
\]

\[
\max_{j=1, \ldots, n} |x_j - y_j|.
\]

For the graphical representation the previous origin and radius will be used. Once again on the axes the points of intersection are (1,0), (-1,0), (0,1) and (0,-1).\(^{11}\) Another set of points is (1,1), (1,-1), (-1,1) and (-1, -1).\(^{12}\) Furthermore the points (.6, .8) and (.5, .5) used with the

\(^{11}\)\(\text{Max} \{ |1 - 0|, |0 - 0| \} = \text{Max} \{ |1 - 0|, |0 - 0| \} = \text{Max} \{ |0 - 0|, |1 - 0| \} = \text{Max} \{ |0 - 0|, |1 - 0| \} = 1.\)

\(^{12}\)\(\text{Max} \{ |1 - 0| |1 - 0| \} = \text{Max} \{ |1 - 0| |1 - 0| \} = \text{Max} \{ |-1 - 0|, |1 - 0| \} = \text{Max} \{ |-1 - 0|, |1 - 0| \} = \text{Max} \{ 1, 1 \} = 1.\)
previous metrics do not meet the required distance for this metric. The graph of the ball for this metric is a square (Figure 44).

\[
d(x,0) = 1.
\]

Figure 44 Graph of a Ball for a Sup Metric

In fact as \( P \) gets larger, the graphs of all \( P \) metrics approach a square in a two dimensional space (Figure 45).

\[
2 < P < \infty
\]

Figure 45 Graph of Balls For Various \( P \) Metrics
APPENDIX B: Criteria Suggested for Selecting Among Accounting Policy Alternatives

A Statement of Basic Accounting Theory

Relevance requires that the information must bear upon or be usefully associated with actions it is designed to facilitate or results desired to be produced. (p 7)

Verifiability requires that essentially similar measures or conclusions would be reached if two or more qualified persons examined the same data. (p. 7)

Freedom from bias means that facts have been impartially determined and reported. (p. 7)

Quantifiability related to the assignment of numbers to the information being reported. When accountants present non-quantitative information in compliance with the other standards they should not imply its measureability. (p. 7)

Snavely

Usefulness requires information to be relevant, reliable, understandable, significant, sufficient and practical. (p. 227)

Relevant information is that which will assist in (1) valuing a firm, (2) evaluating management or (3) evaluating management's policies. (p. 228)

Reliability requires a user must be able to depend on the information as a representation of what it purports to be (p. 228)

Understandability requires the adaptation of the information to the abilities of the information users.

Significance requires that information be important for the user. (p. 230).

Sufficiency focuses attention on the fact that if information is to be useful, a certain quantity and quality must be available. (p. 230)

Practicality requires information to be worth more than it costs to present and must be available on a timely basis (p. 231)
Kenley and Staubus

Relevance. Information which meets the other criteria of useful information is relevant to a decision if it helps the decision maker evaluate an outcome following from one of the courses of action under consideration. (p. 52)

Reliability is that quality which permits users of information to depend upon it with confidence. (p. 53).

Comparability has to do with relationships between accounting practices which contribute to the process of relating two or more financial data. (pp. 54-55).

Neutrality is meant as a positive term for the absence of bias. (p. 56).

Timeliness relates to the frequency of reporting and the lag between the end of the reporting period and the date of the financial statements. (pp. 56-57)

Understandability refers to the fact that data can not be useful if they are not understood. (p. 57)

Optimal disclosure requires that sufficient detail should be provided to meet user's need for information. (p. 57)

Format must be meaningful to the user. (p. 58)

Trueblood Committee

Relevance and Materiality. Relevance is inseparable from the concept of purposeful information. Materiality requires that information should be disclosed when it is likely to influence the economic decisions of users. (p. 57)

Form and Substance. The guidelines for reporting information should be expressed so that substance, not form, governs. The substantive economic characteristics, not the legal or technical form, should establish the accounting for transactions and other events. (p. 57)

Reliability varies with the nature of the information. The most reliable information may not be the most important to users. Users of financial information should be informed about data limitations and the magnitude of possible measurement errors. (p. 58)

Freedom from Bias. There should be no purposeful bias favoring one group. (p. 58)

Comparability means reporting like things alike and unlike things reported differently. (p. 59).
Consistency of method over time is a valuable adjunct to comparability. When information indicates that the current presentation is inappropriate, a new presentation should be adopted. But until that happens, consistency should be observed meticulously. (p. 60)

Understandability. Accounting information should be presented so that it can be understood by reasonably well-informed, as well as by sophisticated users. (p. 60)
APPENDIX C. Proofs of Theorems

(2.2) If \( w_k \geq \sum_{i \neq k} w_i \) and individuals can be represented by any metric then in order to have an optimal solution, \( \Delta^* \), different from the \( k \)th individual's most preferred position, \( x_k \), then

\[
| \Delta_x - \Delta^* | = \frac{\max_{i \neq k} d_i(x_k, \Delta^*)}{\max_{i \neq k} d_i(x_k, \Delta^*)}
\]

Proof

Let \( \Delta^* \) be the solution to \( \min \sum_{j} w_j d_j(x_1, \Delta_j) \) where \( w_k \geq \sum_{i \neq k} w_i \)

1. \( \sum_{i \neq 1} w_id_i(\Delta^*, x_i) \leq \sum_{i \neq 1} w_id_i(\Delta_j, x_i) \) by definition of an optimal solution.

2. \( \sum_{i \neq 1} w_id_i(\Delta^*, x_i) + w_k d_k(\Delta^*, x_k) \leq \sum_{i \neq 1} w_id_i(\Delta_j, x_i) \) substitution.

3. \( \sum_{i \neq 1} w_id_i(\Delta^*, x_i) + w_k d_k(\Delta^*, x_k) \leq \sum_{i \neq 1} w_id_i(x_k, x_i) \) letting \( \Delta_j = x_k \).

4. \( \sum_{i \neq 1} w_id_i(\Delta^*, x_i) + w_k d_k(\Delta^*, x_k) \leq \sum_{i \neq 1} w_id_i(x_k, x_i) \) substitution.

5. \( \sum_{i \neq 1} w_id_i(\Delta^*, x_i) + w_k d_k(\Delta^*, x_k) \leq \sum_{i \neq 1} w_id_i(x_k, x_i) \) for \( d_k(x_k, x_k) = 0 \)

6. \( w_k d_k(\Delta^*, x_k) \leq \sum_{i \neq 1} w_id_i(\Delta^*, x_i) + \sum_{i \neq 1} w_id_i(x_k, x_i) \) subtraction.

7. \( w_k d_k(\Delta^*, x_k) \leq \sum_{i \neq 1} w_i [d_i(x_k, x_i) - d_i(\Delta^*, x_i)] \) factoring.

8. \( w_k d_k(x_k, \Delta^*) \leq \sum_{i \neq 1} w_i [d_i(x_k, x_i) - d_i(\Delta^*, x_i)] \) substitution and property of metrics that \( d_k(x_1, \Delta^*) = d_k(\Delta^*, x_k) \)

199.
9. \( w_i d_k (x_k, \Delta^*) \leq \sum_{i \neq k} w_i d_i (x_k, \Delta^*) \) property of metric

\[ d(y, z) \leq d(y, x) + d(x, z) \]

\[ d(y, z) - d(x, z) \leq d(y, x) \]

\[ d(x_k, x_1) - d(\Delta^*, x_1) \leq d(x_k, \Delta^*) \]

10. \( w_k d_k (x_k, \Delta^*) \leq \sum_{i \neq k} w_i d_i (x_k, \Delta^*) \) where \( d_i (x_k, \Delta^*) = \max_i d_i (x_k, \Delta^*) \)

11. \( w_k d_k (x_k, \Delta^*) \leq \sum_{i \neq k} w_i d_i (x_k, \Delta^*) \)

12. \( \leq \frac{w_k}{\sum_{i \neq k} w_i} \leq \frac{d_i (x_k, \Delta^*)}{d_k (x_k, \Delta^*)} \) substitution

For the proofs to (2.21) to (2.23) let \( \frac{d_i (x_k, \Delta^*)}{d_k (x_k, \Delta^*)} = F' \)

where \( F \) is the ratio of the two distance measures. It follows from (2.2) that \( \frac{w_k}{w_i} \leq F. \) The proofs for (2.21) to (2.23) are based upon (2.2) and Figure 18.

(2.21) In a two dimensional space, if \( I_1 \) can be represented by either a City Block, Euclidean or Sup metric and \( w_k \geq 2 \sum_{i \neq k} w_i \) then

\[ \Delta^* = x_k. \]

Proof:

In a two dimensional space a 45° rotation will make a Sup and City Block metric equivalent then at a maximum (Figure 18) \( d_i (z, y) = 2d_k (z, y). \) Therefore the maximum value of \( F = 2. \)

\[ \frac{w_k}{\sum_{i \neq k} w_i} \leq 2. \text{ If } \frac{w_k}{\sum_{i \neq k} w_i} \geq 2 \text{ then } \Delta^* = x_k. \]
(2.22) In a two dimensional space if $I_k$ can be represented by a City Block metric, all other individuals by a City Block Euclidean or Sup metric and $w_k \leq \sum_{i=1, i \neq k}^{n} w_i$ then $\Delta^* = x_k$.

Proof:
From Figure 18 $d_k(x_k, \Delta^*) \geq d_a(x_k, \Delta^*)$ therefore

$$| \geq \frac{d_a(x_k, \Delta^*)}{d_k(x_k, \Delta^*)}$$

But in order to have $\Delta^* \neq x_k$

$$| \leq \frac{w_k}{\sum_{i=1, i \neq k}^{n} w_i} \leq \frac{d_a(x_k, \Delta^*)}{d_k(x_k, \Delta^*)}$$

Therefore $\Delta^* = x_k$.

(2.23) In a two dimensional space if $w_k \geq \sum_{i=1, i \neq k}^{n} w_i$ and $I_k$ is represented by a Euclidean metric and all other individuals can be represented by a Euclidean or Sup metric then $\Delta^* = x_k$.

Proof:
From Figure 18 $d_k(x_k, \Delta^*) \geq d_a(x_k, \Delta^*)$ and $| \geq \frac{d_a(x_k, \Delta^*)}{d_k(x_k, \Delta^*)}$

But in order to have $\Delta^* \neq x_k$

$$| \leq \frac{w_k}{\sum_{i=1, i \neq k}^{n} w_i} \leq \frac{d_a(x_k, \Delta^*)}{d_k(x_k, \Delta^*)}$$

Therefore $\Delta^* = x_k$.

(2.24) If $\sum_{i=1}^{n} w_i \geq \sum_{j \neq k}^{n} w_j$ where $x_1 = x_2 = \ldots = x_k$ and $d_1(x_1, \Delta^*) = d_2(x_2, \Delta^*) = \ldots = d_k(x_k, \Delta^*)$, the results of (2.2), (2.21), (2.22) and (2.23) are appropriate for this situation.
Proof:

Since \( k \) individuals have the same preferences then redefine \( \sum_{i=1}^{n} w_i = w_k \), \( \sum_{i=1}^{k+1} w_i = 1 \) and \( n = m - (k+1) \) then \( w_k > \sum_{i \neq k}^{n} w_i \) and the previous proofs hold.

(3.1) For formulation (3) the optimal solution, \( \Delta^* \), will be in some individual's or individuals' acceptable region, that is \( d_i(x_i, \Delta^*) < S_i \) for some \( i \).

Proof: (By Contradiction)

1. Let \( \Delta_1 \) be a solution such that for all \( i \), \( \sum_{i=1}^{n} V_i \) is a maximum. That implies \( d_i(x_i, \Delta_1) > S_i \) for all \( i \).
   Therefore \( V_i = 1 \) for all \( i \) and \( \sum_{i \neq k}^{n} V_i w_i = \sum_{i=1}^{n} w_i \).

2. Select another solution \( \Delta_k \) such that for individual \( k \), whose \( w_k > 0 \), then the value of the objective function is \( \sum_{i \neq k}^{n} w_i \) for \( V_i = 1 \) for all \( i \neq k \) and \( V_k = 0 \).
   Therefore \( \sum_{i \neq 1}^{n} V_i w_i = \sum_{i \neq k}^{n} w_i \).

3. Since \( w_k > 0 \) and \( V_k = 1 \) for \( \Delta_1 \) and \( V_k = 0 \) for \( \Delta_k \) then \( \sum_{i \neq k}^{n} w_i + w_k > \sum_{i \neq k}^{n} w_i \).

4. Therefore \( \Delta_1 \) does not meet the criteria of an optimal solution for \( \sum_{i \neq 1}^{n} w_i \leq \sum_{i=1}^{n} w_i \leq \sum_{i=1}^{n} w_i \).

(3.2) For formulation (3) if \( w_k > \sum_{i \neq k}^{n} w_i \) then the solution, \( \Delta^* \), will meet the condition that \( d_k(x_i, \Delta^*) \leq S_k \).
Proof: (By Contradiction)

1. Assume that there exists a point $A^*$ such that $d_k(x_k, A^*) > S_k$ and $A$ is some other solution.

2. Taking a particular $A$ such that $d_k(x_k, A) < S$

3. Given $w_i < w_k$

4. Since $d_k(x_k, A^*) > S_k$, then $V_k = 1$

5. Definition of $A^*$

6. $w_k < 0$ but $w_k > 0$ and $V_k = 1$ for $A^*$

7. Therefore $\sum_{i=1}^{n} w_i V_i + w_k \geq \frac{\sum_{i=1}^{n} w_i}{i \neq k}$ and $A^*$ is not an optimal solution

(3.21) If $\sum_{i=1}^{k} w_i \geq n \sum_{j=k+1}^{n} w_j$ where $x_1 = x_2 = \ldots = x_k$ and $d_i(x_i, A^*) < S_i$ for $i = 1, 2, \ldots, k$, the results of (3.2) are appropriate for this situation.

Proof:

See (2.24)

(3c.2) For formulation (3c) if $I_i'$ ($i = 1, 2, \ldots, k$) have preference such that they are in the feasible region where $I_i$ ($i = 1, 2, \ldots, k, k+1, \ldots, n$) and $w_j \geq \frac{k}{i \neq j}$ where $I_j \in I_i'$ then the optimal solution, $A^*$, will meet the condition that $d_j(x_j, A^*) < S_j$.

Proof:

Substitute $k$ for $n$ in (3.2)
APPENDIX D. Summary of Formulations, Abbreviations and Notation

Primary Formulations

(1) \( V^* = f \left[ W_1, A_j, x_i, d_i \left( . \right) \right] \)

subject to: \( A_j \) being acceptable

(2) \( \min_{A_j} \sum_{i=1}^{n} w_i d_i(x_i, A_j) \)

1. Individual preferences are measured on a continuous scale. If \( d(x_i, A_1) = d(x_i, A_2) - \epsilon \) where \( \epsilon \) is some number close to zero, \( A_2 \) is preferred to \( A_1 \).

2. Policy making body desires to minimize total loss.

3. No constraints on optimal policy selected by policy making body.

(2c) \( \min_{A_j} \sum_{i=1}^{n} w_i \left| x_i, A_j \right| \)

subject to: \( g_k(A) \geq B_k \quad k = (1, 2, \ldots, r) \)

1. Individual preferences are measured on a continuous scale. If \( d(x_i, A_1) = d(x_i, A_2) - \epsilon \) where \( \epsilon \) is some number close to zero, \( A_2 \) is preferred to \( A_1 \).

2. Policy making body desires to minimize total loss.

3. Constraints on optimal policy selected by policy making body.

(3) \( \min_{i=1}^{n} w_i V_i \)

subject to: \( \sum_{j \in N_i} A_j - V_i > 1 \quad i \in (1, 2, \ldots, n) \)

\( \sum_{i=1}^{m} A_j = 1 \)

1. Individual preferences are measured on a continuous scale; and policy making body desires to minimize a level of loss for all individuals.

2. Individual preferences are considered as satisfactory or unsatisfactory.

3. No constraints on optimal policy selected by the policy making body.
(3c) \[ \min_{i=1}^{n} \sum_{j} w_i V_i \]
subject to: \[ \sum_{i \in N_i} A_j + V_i \geq 1 \quad i = (1, 2, \ldots, n) \]
\[ \sum_{j=1}^{m} A_j = 1 \]
\[ g_k(\Delta) \leq B_k \quad k = (1, 2, \ldots, r) \]

1. Individual preferences are measured on a continuous scale; policy making body desires to minimize a level of loss for all individuals.
2. Individual preferences are evaluated as satisfactory or unsatisfactory.
3. Constraints on optimal policy selected by the policy making body.

(4c) \[ \min_{j=1}^{m} \sum_{i} A_j \]
subject to: \[ \sum_{j \in N_i} A_j \geq 1 \quad i = (1, 2, \ldots, n) \]
\[ g_k(\Delta) \leq B_k \quad k = (1, 2, \ldots, r) \]

1. Individual preferences are measured on a continuous scale; policy making body desires to have everyone within a specific level of loss.
2. Individual preferences are evaluated as satisfactory or unsatisfactory and the policy making body desires to have anyone satisfactory.
3. Constraints on optimal policy selected by the policy making body.
Abbreviations

AAA American Accounting Association
AICPA American Institute of Certified Public Accountants
APB Accounting Principles Board
CAP Committee on Accounting Procedure
FAF Financial Accounting Foundation
FASB Financial Accounting Standards Board
FEI Financial Executives Institute
NAA National Association of Accountants
NYSE New York Stock Exchange
SEC Securities and Exchange Commission

Notation

A,B,C,X,Y Policy alternatives
Ci( , ) Stated relationship between two alternatives
di( , ) Metric
D* An area determined by formulation (3)
E ( ) Expected value
\( \xi_k( ) \) A constraint
Ik Interested individual
Is Supplier
Iu User
Iu' A subset of all interested individuals
1c( ) Committee preference function
nk An information system
n Number of interested individuals
Ni Area around \( x_i \) which is within a distance of \( S_i \)
Number of policy alternatives accepted as the policy

\( P_i(S_L) \)  
I_i's estimation of the probability that S_L will occur.

\( P_i(\ ) \)  
Preference of the ith individual for the alternative

\( Q(\ ) \)  
Quantity of information

q  
Individuals not satisfied

r  
Number of Constraints

S_L  
A possible state (Chapter II only)

S_i  
Distance representing critical level

\( V_i \)  
Slack on ith constraint for formulation (3)

\( w_i \)  
Policy making body's opinion of the importance of
the ith individual

\( x_i \)  
Individual's ideal point

x_i  
Individual's least preferred alternative

x_j  
Alternative action that I_i can take (Chapter II only)

\( y_{p/n_k} \)  
A signal from n_k

\( Z_i \)  
A vector indicating importance (weight) of issues to
an individual.

\( Z_i(X_j, S_L) \)  
The payoff to I_i if action X_j is taken and State
S_L occurs

\( \Delta^1_j - \Delta^2_j \gtrless B_k \)  
A constraint

\( \Delta^*_{uc} \)  
Unconstrained optimal policy

\( \Delta^* \)  
Optimal policy

\( \Delta_j \)  
A policy alternative

\( \sum_{i=1}^{m} w_i [d_i(x_i, \Delta^m)] \)  
Value of objective function

\( \| , \| \)  
Norm

\( \boxed{ } \)  
Location of optimal solution

\( + \)  
Then

\( \succ \)  
Preferred to
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