1981

The organizational environment and its effects on organizational processes

Rodney Francis Ganey
Iowa State University

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THE ORGANIZATIONAL ENVIRONMENT AND ITS EFFECTS ON ORGANIZATIONAL PROCESSES

Iowa State University

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The organizational environment and its
effects on organizational processes

by

Rodney Francis Ganey

A Dissertation Submitted to the
Graduate Faculty in Partial Fulfillment of the
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GENERAL INTRODUCTION

Organizations are not like islands. They exist not in a void but rather in a state of constant interaction with entities in their environment. These entities take many forms. They might be individuals or other organizations such as competitors, suppliers, governmental bodies or consumer groups. The presence of their interaction raises a variety of questions for organizational researchers. How do environmental factors effect organizations and conversely how do organizations effect entities in their environment? Additional questions are raised which greatly complicate research in this area such as what constitutes organizational boundaries and what are the organizational structure and process dimensions which adapt to meet the demands of a changing or uncertain environment. This research is designed to address these questions.

Statement of the Problem

Studies of complex organizations have recently focused on an analysis of the environments of organizations (e.g., Dill 1958; Thompson and McEwen, 1958; Emery and Trist, 1963; Lawrence and Lorsch, 1967; Terreberry, 1968; Downey et al., 1975a, 1975b; Pennings, 1975; Meyer and Associates, 1978; Aldrich, 1979). The theoretical grounding for this line of research was laid by the widespread acceptance of systems theory as a basis for organizational analysis (Bertalanffy, 1928 and 1968; Parsons, 1951; Katz and Kahn, 1966; Buckley, 1967). The conception of organizations as open systems interacting with an environment has led to the development of theoretical models of the environments of organizations.
and a limited body of empirical research assessing the effects of interaction between organizations and their environments in terms of organizational structure and processes. The notion that organizations develop structures and processes which are appropriate to the environments in which they find themselves or to the technology they employ in the production process provides the basis for a contingency approach to the study of organizational development (Pennings, 1975). That is, organizations tend to develop along certain lines, in terms of structure and process, given certain environmental characteristics and technological conditions.

The manner in which this development is guided is quite subtle. Most organizational members would find it very difficult to describe how this process operated in their organization. The few people who would be in a position to document the development of the organization would be the organizational elite or key decision makers (Hall, 1977). The key decision makers are those individuals who set the goals and thereby give purpose to the organization. They are responsible for altering the structure and processes of the organization so as to achieve the goals which are set forth. Those individuals or key groups make decisions based upon their perceptions of conditions internal and external to the organization. They assess information concerning the organization's environment and "attempt to fit their structure and processes to the perceived environment" (Hall, 1977:61). Since the information they are basing their decisions upon is often incomplete or reflects a turbulent environment, the key decision makers are confronted with uncertainty concerning the effectiveness of their decisions. This leads us to one of the key concepts in understanding the relationship between organizations and environments, that is, environ-
mental uncertainty or, as it affects organizational members, perceived environmental uncertainty. The distinction between the uncertainty which is perceived and that which is encompassed by the more general concept of environmental uncertainty is an important distinction. Environmental uncertainty has to do with variability in a number of environmental dimensions which can produce a perception of uncertainty, but not all of these dimensions are in fact perceived and further the dimensions have unequal weights in terms of their impact on key decision makers when and if they are perceived.

A large portion of the literature on environment/organization (E/O) interaction is devoted to identifying the dimensions of the environment which produce environmental uncertainty (Emery, 1965; Terreberry, 1968; Duncan, 1972; Aldrich, 1975). Dimensions such as environmental capacity, competition, turbulence, and information feedback have been identified (Aldrich, 1975). Some studies have found a relationship between these dimensions and perceived environmental uncertainty, and further have found a relationship between these dimensions and some organizational structure and process dimensions. For instance, Duncan (1972) found that perceived environmental uncertainty was related to environmental conditions of instability and complexity. Structure and process dimensions such as differentiation, flexibility, decentralization, integration and group decision making have been found to be related to conditions of perceived environmental uncertainty (Lawrence and Lorsch; 1967; Schmidt and Cummings, 1976).

The concept of environmental uncertainty clearly plays an important role in developing our understanding of the interaction between organiza-
tions and environments. Even so, the concept has only recently been employed by organizational researchers and no systematic attempt has been made to ground this concept in the classical social philosophy literature. The first portion of this research will focus on improving our understanding of the concept of environmental uncertainty by analyzing it from a historical perspective. Special emphasis will be devoted to the conceptual contribution made by the Enlightenment philosophers and the nineteenth century social philosophers. A conceptual model of environmental uncertainty will be developed which draws together the historical and contemporary literature and stresses the multidimensional character of the concept.

A second weakness in the current analysis of E/O interaction is a methodological problem which carries over into the general area of social science. Researchers are often faced with the problem of trying to develop measures of multidimensional concepts such as environmental uncertainty that possess both validity and reliability. The issue of validity is normally not subject to empirical verification unless you can apply a criterion test or are able to use the multitrait-multimethod analysis (Campbell and Fiske, 1959), or use judges where evaluations are quantified. For the most part, face validity is relied upon or, more appropriately in the case of multidimensional concepts, content validity is employed. Multidimensional concepts typically are concepts whose sampling domain has various substrata representing the various dimensions of the concept. Since these substrata all come from the same sampling domain, they will be correlated highly and positively with one another. This relationship is assumed when one uses factor analysis, canonical correlation or the
traditional methods for assessing the reliability of a composite (Bohrnstedt, 1970).

A problem arises when the dimensions of a concept are not highly and positively intercorrelated. This situation occurs when there are multiple sampling domains represented by the dimensions. This may be the case even when the researcher has sound theoretical grounding for representing the concept via all of the identified dimensions. In this situation, the composite measure would be valid but would not be reliable using traditional reliability estimation techniques such as internal consistency, split-half and test-retest. This dilemma is often avoided by redefining the concept to a single sampling domain. In some cases, such as social indicator research, this results in moving from a multiple indicator analysis to a single indicator analysis.

The concept of environmental uncertainty appears to be a multidimensional concept in which the dimensions are not highly and positively correlated (Tosi et al., 1973; Osborn and Hunt, 1974). Researchers have, therefore, tended to limit their analysis to one or two dimensions of environmental uncertainty, thereby losing some of the richness of the concept and comprising the validity of their measure.

The second phase of this research will focus on the methodological problems associated with measuring a concept particularly when the dimensions are not highly and positively correlated. This will lead to a unique application of a little used psychometric approach to estimating the reliability of a linear composite. The appropriate application of this technique to structural parameter estimation via the measurement error
correction procedures of errors-in-variables and confirmatory factor
analysis will be explored.

The third phase of this research will build off the first two phases
in terms of the conceptualization and measurement of environmental uncertainty and will involve an empirical analysis of the impacts of perceived environmental uncertainty on organizational structure and process, and ultimately on organizational goal attainment. Some of the research in this area has been cited previously. The research in this area has overwhelmingly dealt with bivariate relationships between single indicators of each concept. The proposed research will involve structural equation modeling using confirmatory factor analysis to examine the effect of perceived environmental uncertainty on County Extension organizations in Iowa.

The three objectives of this research can, therefore, be summarized as follows.

1. Examine the historical social science literature on the subject of environmental dynamics and its effect on social units.

2. Examine and resolve some of the methodological problems associated with using multidimensional concepts in social research, particularly, focusing on the estimation of reliability for multidimensional concepts where there is a low average intercorrelation between the separate dimensions.

3. Develop and empirically evaluate a theoretical model of the effect of perceived environmental uncertainty on organizational structures and processes in County Extension organizations in Iowa.

Explanation of Dissertation Format

This three-phase research plan may be best approached through the new alternate dissertation format. This format allows for the inclusion within
the dissertation of papers suitable for separate submission to appropriate professional journals. In this case, three separate papers will be prepared based on the three interrelated topics and objectives specified above. This format is appropriate for the proposed research because the three objectives of the research are somewhat distinct in that a unique contribution to the discipline will be made in each area. Further, each area could conceivably be a dissertation topic in and of itself, yet the topics are joined by a logical progression of thought from conceptualization through methods and into an applied analysis. This format for the dissertation is particularly well suited to examining the three interrelated objectives outlined above and yet facilitates separate presentation of the unique contribution of each.
SECTION I. HISTORICAL CONCEPTUALIZATION OF ENVIRONMENTAL UNCERTAINTY
Historical conceptualization of environmental uncertainty

Rodney F. Ganey

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Introduction

Contemporary literature on environment/organization (E/O) interaction tends to focus on the concept of environmental uncertainty. This concept can be generally defined as a difficulty in predicting the outcomes of organizational choices. This concept is crucial to the study of E/O interaction because it provides a direct link between the attainment of organizational goals and the myriad of factors which are outside of the organization's control at the time decisions are made, but which can affect organizational structure and processes as well as goal attainment. A variety of studies have established evidence in support of a linkage between organizational variables and environmental conditions such as turbulence, complexity and resource scarcity. Additionally, individual social psychological factors are suggested to be crucial in determining the degree to which environmental uncertainty is evidenced by members of an organization (Downey et al., 1975a, 1975b).

Although the concept of environmental uncertainty is widely used in this area of research, its etiology has not been well-established and its historical roots have not been documented. The goal of this paper is to document the historical development of this concept, and in so doing, to establish a better model of its etiology.

The historical roots of environmental uncertainty are often traced only as far back as the work of Dill (1958) or Thompson and McEwen (1958). In rare instances, it is traced to the work of von Bertalanffy, Ashby, and Parsons (c.f., Emery and Trist, 1963; Terreberry, 1968). In this paper, the concept of environmental uncertainty will be traced as far back as the
early Greek philosopher, Hippocrates. Special emphasis will be placed on the Enlightenment philosophers and the work of Spencer, Marx, Durkheim and Weber. It will be shown that perceptions of environmental turbulence, competition and resource scarcity have been taken into account by many of the classical social theorists and a link will be established between these theorists and contemporary conceptualizations.

General Considerations

There are a few general characteristics of the environment that must be considered prior to analyzing the early conceptualizations of the environment and the etiology of environmental uncertainty. The first consideration has to do with defining what is the environment. Recently, authors have noted that environments are both internal and external to organizations (Pennings, 1975). A crude definition of the environment is anything outside of the unit of interest which affects or is effected by the unit of interest. Therefore, an organization's environment is anything outside of the organization which in some way affects the organization's structure or processes. We may also conceptualize the unit of interest to be the specific members of an organization who are engaged in organizational decision making. For these members, considerations of both internal and external environmental circumstances are of importance in determining perceptions of uncertainty. Note that it is often very difficult, if not impossible, to clearly set boundaries around a unit. Therefore, the criterion of exclusiveness is more heuristic than empirical. Most of the contemporary work on the environment has concentrated on the environment of organizations, but the early social theorists were not usually dealing
with organizations as a unit of analysis, and therefore, their conceptualizations are often thought to not have relevance for organizational environment conceptualizations. One of the goals of this paper will be to show that this is a misconception. Although the early social philosophers did not deal extensively with economic organizations (Spencer and Weber are notable exceptions), they did provide the groundwork for contemporary systems theory and environment analysis through considerations of the physical, political and social environments of men and in some cases economic organizations.

A second consideration is the nature and direction of the relationship of the environment to the unit of analysis. There are three possible specifications for this relationship. First, the environment may have an impact on the unit of analysis. This is the classical relationship, which in its extreme form, is labeled environmental determinism (c.f., Febvre, 1925; Huntington, 1924; Spate, 1952). Second, the unit of analysis may impact the environment. One form of this is the proactive strategies employed by organizations to make their sometimes hostile environment more amiable to organization goal attainment (c.f., Pennings and Goodman, 1977; Osborn and Hunt, 1973; Thompson, 1967). The third form of this relationship is the truly interactive situation where both the environment and the unit of analysis affect each other. This form of relationship is consistent with the tenets of general systems theory, and is probably the most widely ascribed to description of the relationship (c.f., Katz and Kahn, 1966; Buckley, 1967; Seashore and Yuchtman, 1967). This third form of the relationship is also the most difficult to examine empirically due to the lag times inherent in proactive strategies.
The last general consideration has to do with the way the environment is conceptualized. Contemporary writers have been very concerned with identifying environmental dimensions. These dimensions have included placid-turbulent (Emery and Trist, 1963; Terreberry, 1968), stable-dynamic and simple-complex (Duncan, 1972), and certain-uncertain (Lawrence and Lorsch, 1969). This growing field of literature illustrates the need for a better understanding of the nature of the environment. One way to facilitate this understanding is to look back to the masters. They often developed conceptions of the environment in order to illustrate their theories and in many respects we have not greatly improved our understanding of the environment beyond these early conceptions.

Greek Social Philosophers

Man's earliest conceptualizations of the environment were dominated by religious and mystic bias. Written documentation is sparse from this period, but anthropological evidence confirms this proposition. The Greek philosophers appear to be the first to develop a clear systematic specification of the environment. Hippocrates' work, "On Airs, Waters, and Places," is often considered the first work to specify the effect of the environment on social life. Hippocrates, writing in the fourth century B.C., developed an environmental determinism argument as is evidenced in the following passage:

In Asia the country is civilized and its inhabitants in their different nations are milder and more patient of toil. The cause of this is temperature of the seasons—Asia lies toward the east midway between the risings of the sun, and is situated farther from the cold (than Europe is) (Hippocrates, 1934:54).
Hippocrates' unit of analysis was man or mankind. This was undoubtably a function of his interest in curing illness in man. He did deal with nations, but only as aggregates of people. The various climatic conditions which he perceived led him to conceptualize the effects of static as well as dynamic environments.

For where the changes in the seasons are most frequent and differ most widely one from another, there you will find the greatest difference in physique, manners, and natures alike (Hippocrates, 1934:59).

This passage may be applied directly to the contemporary organizational studies which explain the evolution to diversified organizational types as a reaction to increasingly complex and turbulent environments. Hippocrates also discussed the effects of different political systems on the nature of man. He claimed that people who are ruled by a king are less likely to be warlike than those who are not ruled by a king.

Later Greek philosophers such as Plato and Aristotle followed in the environmental determinist perspective of Hippocrates, although they did shift the unit of analysis to the republic or city-state in some of their works. They were particularly concerned with the proper geographic placement of city-states. The work of these Greek philosophers began the environmental determinist tradition. The repercussions of their work can be seen in the multitude of studies which specify a one-way, environment affecting unit of analysis, relationship. Plato's unique contribution to this analysis was his conceptualization of the political environment of men. Plato viewed his political environment as chaotic and hostile to man's freedom and flourishing. Robert Nisbet (1973:108) points out that Plato was thoroughly disgusted with all extant forms of government and saw
the need for constructing a new form of rational government which would be a good and beautiful political community. This conceptualization is important in two ways. First, it moved the environment from the physical or climatological to the manmade or social. This started a current in environmental conceptualizing quite distinct from the trend started by Hippocrates. Second, Plato's conceptualization of the Republic was such that it had supra-organic qualities. Nisbet clearly shows the direct relationship from Plato's Republic to the Leviathan of Hobbes and to the state of Rousseau. All three were reacting to "an overpowering perception of the world as conflict ridden, disorganized, tending toward the anarchic, and needing therefore, the sovereign anodyne of community" (Nisbet, 1973:108). The political community notion subsequently led to the larger notion of society which became the unit of analysis for the nineteenth century socialists.

Enlightenment Philosophers

The next major group of social philosophers who dealt with the environment were the Enlightenment philosophers of the seventeenth and eighteenth centuries. As noted above, Hobbes and Rousseau were greatly influenced by the work of Plato. They both perceived a turbulent environment and saw the only hope for human development as resting with a rational and powerful state. The turmoil in mid-seventeenth century England involving the fall of King Charles I and the rise of the Puritans under Cromwell was a very real environment for the exiled Hobbes. It led to his conceptualization of man's innately evil nature and his prescription for a strong state. Note the proactive character of this thesis, and its
similarity to Plato's prescription. Both stated that man could create a more placid environment if he would apply a rational philosophy to the political structure, which would at once take care of the problems inherent in social organization, and free man to engage in the higher pursuits of philosophy, exchange and the arts. Here the unit of analysis, man, or in Hobbes' case, society, could alter the environment to fit human development.

The following passage from "Leviathan" illustrates the effects of a turbulent and uncertain environment on man and society.

Whatsoever therefore is consequent to a time of Warre, where every man is Enemy to every man; the same is consequent to the time, wherein men live without other security, than what their own strength, and their own invention shall furnish them withall. In such condition, there is no place for Industry; because the fruit thereof is Uncertain; and consequently no culture of the Earth; no Navigation...no Arts; no Letters; no Society; and which is worst of all, continuall feare, and danger of violent death; and the life of man, solitary, poore, nasty, brutish and short (Hobbes, 1951:97).

The reference to an uncertain economic situation has direct relevance to the current proliferation of research on perceived environmental uncertainty (c.f., Lawrence and Lorsch, 1969; Duncan, 1972; Tosi, et al., 1973; Downey, et al., 1975a, 1975b). Hobbes dealt with society as a unit of analysis when he asked the trenchant question, how is social order possible? Beyond his overall analysis of political systems, he had an avid interest in the progress of industry. In fact, Hobbes' stress on creating an environment for rational economic exchange was precursory to the work of Max Weber who also discussed the need for a rational, certain, environment as a prerequisite for bureaucratic organization. Note that although Hobbes saw the political system as a means for establishing order for men and society, he did not go the further step to analyze how the monarchy would
react to changes in its environment. This would constitute a shift in unit of analysis to the political organization itself. Hobbes does approach this question in his comparison of monarchy, democracy and aristocracy, insofar as he evaluates monarchy most highly for its ability to handle situations of uncertainty and produce order.

The difference between these three kinds of commonwealth, consisteth not in the difference of Power; but in the difference of Convenience, of Aptitude to produce the Peace, and Security of the people; for which end they were instituted...Thirdly, that the Resolutions of a Monarch are subject to no other Inconstancy, then that of Human Nature; but in assemblies, besides that the Nature, there ariseth an inconsistancy from the Number (Hobbes, 1951:143-144).

The social philosophy of Montesquieu and Rousseau emphasized the effect of the social and political environment on man. Their unit of analysis was society, although they were very concerned with the effect different forms of society had on individuals. Durkheim (1960), who was greatly influenced by both Montesquieu and Rousseau, developed a series of lectures on these social philosophers. In the lectures, he stresses the societal analysis of components of their work. For Durkheim, Montesquieu was clearly focusing on the society.

In the first place, Montesquieu's science is really social science. It deals with social phenomena and not with the mind of the individual (Durkheim, 1960:17).

On the other hand, Rousseau dealt with both units, the individual and society.

Rousseau attempts at least to solve the problem (the origin of society) without abandoning either of the two principles in question, the individualist principle (which underlies his theory of the state of nature as well as Spencer's theory of natural law) and the contrary principle (which might well be called the socialist principle...), which is at the base of his organic conception of society (Durkheim, 1960:85).
Montesquieu was impressed by the Greek philosophers and expounded on their notion of environmental determinism. He stated that the best political and societal form was dependent on environmental circumstances. According to Montesquieu, man should achieve order by accepting the social reality of inequality, and by attempting to balance conflicting social powers (Strasser, 1976). Man is therefore subject to his social environment and, in turn, the social environment is dependent on the physical environment. Montesquieu might be categorized as the first contingency theorist.

Rousseau continued this line of thinking, but his criticism of society and the political system was much more harsh. He literally blamed all the ills of man on his social environment.

It was the individual's freedom that obsessed Rousseau above all else—but freedom from society, not from the state. It was society that drew Rousseau's harshest criticisms: society in the sense of the traditional institutions of the church, guild, extended family... etc. Here, as I have indicated, Rousseau found nothing but hypocrisy and uncertainty (Nisbet, 1973:148).

The Enlightenment philosophers found man's social environment to be rife with turmoil and uncertainty. This, above all else, was their contribution to the conceptualization of the environment. They felt the environment should follow rational laws and should be stable. The political systems which were valued the highest were those which could bring about order and reduce uncertainties, even though these systems were, at the same time, being criticized as stifling human freedom. They tended to advocate an environmental determinist perspective, although they generally felt the environment was manmade and could therefore be altered by men.
Herbert Spencer developed the theory of evolution in the context of organicism. This led to two striking developments in the conceptualization of the environment. First, the evolutionary theory gave preeminence to the role of the environment in selecting the best social system. Only those social systems which could adapt to the environmental forces would survive. Spencer credited the English and American societies as the best adapted.

Spencer compares England's response to population pressure with Ireland's (in a manner strikingly foreshadowing T. S. Ashton), and says Ireland's catastrophe was due to her failure to adapt—the struggle being not against England, but against nature (Peel, 1971:147).

The above passage leads into the second major contribution of Spencer. He stated that in the early evolution of societies, they engaged in direct competition or war in order to determine which was the strongest, most adaptable social system. Notice that Spencer has taken the step that Hobbes only alluded to. The environment of the early societies, according to Spencer, was composed of other societies competing for territory and resources. Therefore, the environment of a society was other societies, much as the contemporary environment of an organization is conceptualized as those other organizations who compete with the focal organization for scarce resources. Now, as then, the social unit which is best adapted and most flexible will be the one to survive. Spencer viewed contemporary societies as developed beyond the need for military competition with industrial competition becoming the major selecting process.

To this point, Spencer's focus on the society as a unit of analysis has been stressed. Spencer also devoted a large portion of his work to analyzing the individual and to some extent organizations. Peel (1971:44)
notes that Spencer was "unable either to reconcile, or to choose between two traditions both of which he was heir to: environmentalist and hereditary." This was the nature versus nurture debate. To be sure, Spencer placed a heavy emphasis on the role the social environment played in determining human development, but he also recognized that "the sum of past environmental influence, 'organized' as character or race," played a firm role in man's ultimate development (Peel, 1971). Within a given social system, Spencer advocated the need for a laissez-faire social welfare policy. Those who cannot survive in the environment should not survive. This was the way natural selection had to operate in order to see to it that humanity progressed and evolved along with the social system.

Spencer's contributions to modern systems theory has been great. His conception of society as an organism, the functional interrelationships of the organismic parts and the need for adaptability in an ever-changing environment were seminal thoughts in the development of systems theory. In turn, systems theory has provided the basis for contemporary environmental research. The evolutionary perspective of a competitive, challenging environment has directly carried over into contemporary conceptualizations.

Emile Durkheim

Emile Durkheim advanced the notions of Montesquieu, Rousseau and Spencer into a conception of society which was firmly emergent from the contributions of individuals. Durkheim's unit of analysis was society. To Durkheim, this was the only proper subject matter of sociology. Social facts were the emergent properties of social systems which were not derivable from a summation of the individuals in a society. Durkheim thought
that social facts must be studied because these emergent facts would directly affect the minds of all individuals in a society. Note that Durkheim, like Montesquieu and Rousseau, saw society as being the environment of the individual, but he went beyond these early philosophers in emphasizing that it was the social environment and not the physical environment which was most important in human development.

Individualistic positivists in their "ethical" phase laid emphasis on the external environment and human nature in various relations and aspects. Since these will not suffice, Durkheim adds the third category—social environment. The term he most frequently uses, the milieu social, is characteristic of this mode of thought. The social reality is precisely thought of as an environment, as an external reality to which the individual reacts or which acts upon him. It is to the facts of this reality that he must adapt himself (Parsons, 1937:371).

At the societal level of analysis the social structure was very much dependent on its preceding social structure. Nisbet notes that, although Durkheim spends a good deal of time developing an argument for demographic and moral density producing the movement from mechanistic to organic society, it is, in fact, prior social facts and their interaction which produce social facts.

The determining cause of a social fact should be sought among the social facts preceding it and not among the states of the individual consciousness (Nisbet, 1974:247).

The concept of the social milieu is, therefore, an encompassing force which not only represents the environment of the individuals but also the environment of society itself. This appears to be a very closed perspective. Although an individual's environment is composed of physical, social and genetic inputs, the social structure is affected only by preexisting social facts. There is, in Durkheim's scheme, nothing of importance external to
the social milieu which would affect the social system. The social milieu itself was conceptualized as very dynamic. The forces of the industrial revolution and political revolution were producing great changes in the social order and it was these changing social facts which Durkheim studied most closely. He was interested in the forces of interaction which helped society to weather the dynamic changes in the social milieu. These forces, such as the "conscience collective," were social facts which maintained order in this tumultuous era.

Max Weber

Max Weber is often credited with developing the closed system model of organizations.

The closed system perspective is traditionally tied to Max Weber's early writings on bureaucracy. While Weber has been overly criticized for ignoring factors that would deflect an organization from a pure closed system, much of his writing is concerned with how organizations can structure themselves for the utmost rationality (Hall, 1977:49).

One of the major characteristics and criticisms of this model is that it does not consider the environment of organizations. This has been generalized into the assumption that Weber does not consider the environment in his work. To the contrary, Parsons (1937:677) indicates that he was influenced by Weber's treatment of the environment in relation to the social action model.

It almost goes without saying that for Weber as for the other writers here dealt with the factors formulable in nonsubjective terms, heredity and environment, play their part in the determination of concrete action....Nowhere does Weber take an actual role for these elements....But he was open-minded as to the possibility of their providing significant elements of explanation on any particular problem.
Therefore, environmental considerations were important to social action, which by definition may be related to an individual unit of analysis or to social groups, such as organizations. This is in contradiction to the closed system model. The source of the error in interpretation lies in an inadequate understanding of Weber's methodology. For Weber, the bureaucratic model was an ideal type which, therefore, could not have an empirical referent. Weber used this model as a heuristic device to increase understanding of the rational end of his organizational typology. Weber clearly implies that the bureaucratic organizational type is only appropriate in stable, predictable environments.

Bureaucracy, moreover, is a permanent structure and is well adapted, with its system of rational rules, for the satisfaction of calculable long-term needs by normal methods (Weber, 1978:226).

On the other hand, Weber also clearly implies that the charismatic type of organization is well adapted to periods of environmental turmoil.

In other words, the 'natural' leaders in times of spiritual, physical, economic, ethical, religious or political emergency were neither appointed officials nor trained and salaried specialists. . .but those who possessed specific physical and spiritual gifts which were regarded as supernatural, in the sense of not being available to everyone (Weber, 1978:226).

It would be appropriate to classify Weber as an advocate of contingency theory. That is, the best structure of an organization is dependent on the particular environmental conditions of the organization's milieu.

In Weber's work, we again see a one-way model of environment affecting the unit of analysis. Weber has identified ideal types of environmental conditions. It would be inappropriate to think that either of these ideal types have empirical referents. Weber does see a movement toward more rational forms of organizations, but there is a wide continuum along which
the environmental and organizational forms may fall. Weber's main contributions to the conceptualization of the environment is his connection between environmental form and organizational form and his development of a dichotomy of environmental foci.

Contemporary Research

Contemporary researchers have found environmental dimensions similar to the classical social thinkers. The dimensions of turbulence (Terreberry, 1968) competition and complexity (Duncan, 1972) and resource scarcity (Emerson, 1975) are found throughout the literature (c.f., Hall, 1977; Aldrich, 1979). In addition, dimensions such as environmental stability, homogeneity, concentration, domain consensus, feedback and mutability have also been identified (Hall, 1977). For the most part, the unit of analysis for this research has been the organization in relation to its environment. The direction of the relationship is typically from the environment to the organization, although there are some exceptions. One of the newest areas of investigation deals with the impact of subjective personal characteristics of key decision makers upon their perception of environmental uncertainty (Downey et al., 1975a, 1975b). Downey et al. (1975b) have proposed that these personal traits play a predominant role over objective environmental criteria in determining perceived environmental uncertainty. Since these are traits of members, the personal traits might be categorized as a part of the internal environment of organizations as opposed to environmental dimensions which are external to the organization, such as competition with other organizations or changes in socioeconomic conditions.
Generally, few attempts have been made to prioritize the dimensions of the environment in terms of their impacts on perceived environmental uncertainty. Such an attempt would be faced with the difficulty of generalizing environment to diverse forms of organization. The contingency theory approach to E/O interaction would say that environmental conditions change with each organization and that the organizational structures and processes which are developed are determined by the particular environmental conditions the organization is faced with. Just as Hippocrates and Montesquieu have pointed out in relation to other units of analysis, the organization will adapt itself to its environment, and given a multidimensional environment, it will adapt itself to the dimensions which seem most relevant to the reduction of uncertainty in organizational decision making.

Conclusion

This paper represents a first attempt at drawing together the historical social science literature on the subject of environmental dynamics and its effect upon social units. Since this is a first attempt, an effort has been made to be relatively inclusive of major contributions. This approach could lead to a rather scattered collection of perspectives and ideas, but criteria outlined in the first section should help tie together the ideas of these profound social thinkers. One should note that these social philosophers tended to build on the work of their predecessors. The Greek philosophers Hippocrates, Plato and Aristotle, began the tradition of environmental determinism. Their unit of analysis was generally the individual. The environment was typically physical and in some instances political, and
it was considered to vary widely on the dimensions of complexity, rate of change and severity. The Enlightenment philosophers, Hobbes, Montesquieu and Rousseau, were very much influenced by this tradition. They also conceptualized the environment as tumultuous, and, as Plato had done centuries earlier, they advocated the development of a rational, powerful state. They were very concerned about the effect of an unstable environment on individuals, and advocated a movement toward a more perfect, stable political situation. Hobbes went one step farther in identifying the relationship between the environment and uncertainty in organizations. During this time a more clear conceptualization of society as a unit of analysis began to emerge, particularly in Hobbes' and Montesquieu's work. This foreshadowed the societal analysis of Marx, Spencer and Durkheim. All three of these social thinkers moved up from the individual to group or societal units of analysis. They also conceptualized the environment as changing and unstable. Spencer's notion of other societies as part of the focal society's environment was unique. Weber took this analysis to organizations and clearly understood the effect of the environment on organizational structure and processes. He developed a dichotomy of environmental types which was influential in the development of systems theory. Parsons (1937) documents the contribution of Spencer, Durkheim and Weber to his social action theory which was later expanded to the theory of social systems (Parsons, 1951). Parsons' (1951) systems theory has played a key role in opening up the contemporary field of E/O interaction.

The contemporary emphasis on organizations and organizational decision makers as units of analysis has tended to focus the conceptual models of the environment into those components which effect organizational structure
and processes. A key concept in this research is the perception of uncertainty by decision makers which can be directly attributed to environmental turbulence, competition, resource scarcity and other environmental conditions.

The roots of the concept of environment run deep into the history of social philosophy. It is interesting to note that in every age the environment has been conceptualized as dynamic and having a great impact on individuals, organizations and society.
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SECTION II. RELIABILITY ESTIMATION FOR MULTIDIMENSIONAL CONCEPTS
Reliability estimation for multidimensional concepts

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Introduction

The estimation of scale reliability has been a crucial aspect of social science research since the turn of the century (c.f., Spearman, 1904; Guttman, 1945; Cronbach, 1951). Various estimation techniques have been developed which are dependent upon the specific research situation e.g., test-retest, internal consistency, split-half and parallel forms. The predominant contemporary technique used in sociology for estimation of reliability is the internal consistency approach, typically using Cronbach's alpha. This approach assumes that the items which make up the scale or composite are highly and positively interrelated. This assumption is valid for most research situations and does not normally inhibit the development of scales and their use in research. One area where this assumption has presented problems is in the area of social indicator research. In this area, multiple indicators are often used to measure multidimensional concepts and although the theoretical rationale for using these indicators is quite strong, the empirical relationship between the indicators are often very weak or negative. The indicators of the separate dimensions are essentially measuring different traits of the same concept and therefore do not correlate highly with one another.

Review of the Problem

Low reliability estimates, which are derived from multidimensional social indicator composites, have hindered the development and testing of social indicator models. There are two major options available to researchers facing this problem. First, regardless of theory and conceptuali-
zation, the researcher may select only indicators which are highly and positively interrelated or use single indicators. This often results in developing a set of measures which are artificially highly related due to the confounding effect of demographic or economic circumstances. The multidimensional concepts are represented by single dimensional measures which are often inappropriately assumed to have no measurement error. Multicollinearity becomes a serious problem for this approach especially when one is trying to develop structural parameter estimates (Land and Felson, 1976; Pampel et al., 1977). The second approach is to use a block recursive model where multiple partial correlation (MPC) coefficients are derived to test relationships (Sullivan, 1971; Warren et al., 1980). This approach has the advantage of utilizing a more representative set of dimensions and also provides the MPC as a test of the goodness-of-fit for the model. The key drawback for this approach is that it does not provide a clear estimate of structural parameters (multiple estimates are derived for each parameter) and the goodness-of-fit tests are often dependent on an interpretation of sets of MPC coefficients which may yield conflicting results.

Clearly, both of these two approaches have serious drawbacks and neither approach can provide unique estimates of structural parameters. A technique is needed to allow for building reliable composite measures of multidimensional concepts where the dimensions are not highly and positively related. Such a technique has been developed in the psychometric literature but its usefulness has not been documented in the sociological literature. The technique for estimating the reliability of linear composites which measure multiple dimensions or separate sampling domains was developed by Nunnally (1978). A review of the approach will be given here.
as will a critique of its usefulness in sociological research. Particular emphasis will be paid to documenting the strengths and weaknesses of the approach. Additionally, the applicability of the approach to the more sophisticated techniques of Fuller's (1971) errors-in-variables analysis or Jöreskog's (1970) analysis of covariance structures will be discussed.

There are two basic approaches to estimating the reliability of linear composites outlined by Nunnally (1978). Where you have parallel forms of the elements in the linear composite, you may generate multiple composite scores and use an internal consistency approach such as Cronbach's alpha to estimate the reliability of the composites.

The second approach assumes that you have known reliabilities for the elements in the linear composite or assumes that you can estimate the reliabilities of the elements. For example, if you are developing a composite measure of socioeconomic status and you are using measures of education, occupation and income, these measures must have established reliabilities or be scales, in and of themselves, whereby you can estimate their reliability. Estimates of reliability for each dimension may be derived using an internal consistency measure such as Cronbach's alpha, since the items measuring the dimensions are taken from the same sampling domain. The basic assumption underlying this approach is that if you can theoretically justify forming a composite of elements which are not necessarily related then the reliability of the composite should not be determined by the average interitem correlation but rather should reflect the reliabilities of the elements themselves. The case of socioeconomic status is a good example of how this approach provides a more realistic estimate of reliability than does the traditional approach of internal
consistency. Education, occupation and income are often very highly and positively interrelated, but this is not the case for many subgroups within the population. Subgroups such as women, minorities and occupational groups such as university professors are cases in point. It also might be noted that within society as a whole the relationships between these dimensions are constantly shifting. Still there are good theoretical grounds for combining these indicators into an overall measure of socioeconomic status. A change in socioeconomic status should be reflected in or measured by a change in indicators of these key dimensions of socioeconomic status. The combination of these dimensions should reflect the multidimensional character of the concept even though the dimensions may not be highly and positively interrelated.

Nunnally (1978) showed that the reliability of a linear composite can be estimated if we can derive true variance estimates to substitute into the observed covariance matrix thereby transforming the matrix into a true covariance matrix. Reliability can then be estimated by the ratio of true variance over observed variance. Figure 1 depicts the difference between an observed covariance matrix and a true covariance matrix.

<table>
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<tr>
<th>Observed Covariance Matrix</th>
<th>True Covariance Matrix</th>
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<tr>
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Figure 1. Comparison of Observed and True Covariance Matrices
Note that the summation of the elements in the observed covariance matrix will yield the observed variance of the composite \( \sigma^2_y \) and the summation of the elements in the true covariance matrix will yield the estimated true variance of the composite. Reliability may then be estimated by the general formula (Nunnally, 1978:248):

\[
 r_{yy} = 1 - \frac{\sum \sigma^2_i - \sum r_{ii} \sigma^2_i}{\sigma^2_y} \tag{1}
\]

in the case of standardized variables where \( \sigma^2_{y*} \) is the composite variance.

\[
 r_{yy} = 1 - \frac{k - \sum r_{ii}}{\sigma^2_{y*}} \tag{2}
\]

The formulae are also appropriate for linear composites where some variables are subtracted from others to generate the composite:

\[ y = x_1 + x_2 - x_3 \]

Although it should be noted that there are limits to the appropriateness of this technique for situations where negative elements are in the equation.

Nunnally's approach to estimating the reliability of a linear composite can also be viewed as a basic extension of the classical reliability ratio:

\[
 r_{xx} = \frac{\sigma^2_{true}}{\sigma^2_{observed}} \tag{3}
\]
Note that if we were to substitute the appropriate estimation equation in equation 3, we would estimate the true variance of two elements as follows:

\[ \text{True } \sigma^2_{(A+B)} = \text{True } \sigma^2_A + \text{True } \sigma^2_B + 2(\text{True Cov}_{AB}) \]  

(4)

Since the true covariance is the observed covariance and since the true variance of A and B is the observed variance times the respective reliability, the estimation equation for the true variance of (A+B) is as follows:

\[ \text{True } \sigma^2_{(A+B)} = \sigma^2_A \rho_A + \sigma^2_B \rho_B + 2 \text{Cov}_{AB} \]  

(5)

The observed variance of (A+B) can be calculated directly or by the following formula:

\[ \sigma^2_{(A+B)} = \text{True } \sigma^2_{(A+B)} + (\sigma^2_A - \sigma^2_A \rho_A) + (\sigma^2_B - \sigma^2_B \rho_B) \]  

(6)

This formula is simply the summation of the true variance of the composite and the error variances associated with each element. Reliability can then be estimated from equation 3 by substitution into equations 5 and 6 yielding the general formula:

\[ \hat{\rho}_{(A+B)} = \frac{\frac{\sigma^2_A \rho_A + \sigma^2_B \rho_B + 2(\text{Cov}_{AB})}{\text{True Variance}_{(A+B)}}}{\frac{(\sigma^2_A - \sigma^2_A \rho_A) + (\sigma^2_B - \sigma^2_B \rho_B)}} \]  

(7)

Equation 1 is obviously a more manageable equation and should be used in computing the reliability of a linear composite, but equation 7 allows one to examine more directly the intricacies of the approach. For instance, note that the reliability estimate from equation 7 is very much dependent on the size of the variances of each indicator. Nunnally has pointed out that the range of possible values of the reliability estimate will be
determined by the reliabilities of the elements. In other words, when the \( \tilde{r}_{ij} \) is positive or zero the lower limit of the \( \hat{\rho}_{(A+B)} \) will be the lowest of the element reliabilities. The \( \hat{\rho}_{(A+B)} \) will be at least as high as the average of the reliability coefficients if the elements have equal variances, but if the variances are not equal the \( \hat{\rho}_{(A+B)} \) will be weighted toward the element with the highest variance. Therefore, just as the \( \sigma^2_{(A+B)} \) is weighted by the variances of the elements so is the \( \hat{\rho}_{(A+B)} \). The estimated reliability of the composite is also influenced by the magnitude of the correlation between the elements. Nunnally (1978) has shown that the inter-element correlations need not be positive to estimate the reliability using this technique although as noted above there are some limits beyond which negative correlations will produce zero or negative reliabilities.

This strategy for estimating composite reliability based upon element reliabilities merits close examination not only as a means for scale construction and measurement, but also in terms of proposition formation and hypothesis testing. For instance, suppose one set out to evaluate the structural relationship between socioeconomic status (SES) and alienation. SES might be measured by some operational indicators of the three dimensions income, education and occupation. Alienation might be measured by some operational indicators of the three dimensions powerlessness, normlessness and social isolation.

Figure 2 depicts a proposed model including both the congeneric measurement model and the structural equation model. Note that no correlated error terms are included and each indicator is only related to the concept it is purported to measure. This is only one of a variety of
alternative models that are possible. For instance, one might propose that education is a function of alienation as well as SES or that powerlessness is as much a function of SES as alienation. These models present problems of identification, but they are potentially resolvable using congeneric measurement models as the basis for estimating structural relationships. Costner and Schoenberg (1973) developed a strategy for diagnosing and resolving indicator ills in these three indicator submodels but they do not address the issue of low intercorrelation between the indicators of one of the traits. This problem lies at the base of applying multidimensional scales to structural equation models using congeneric measurement models. The confirmatory factor analysis technique developed by Karl Jöreskog and Dag Sörbom (1978), LISREL, for estimating structural equation models relies on the congeneric measurement model, as shown below.

\[ x = \Lambda f + e \]  

In this model, \( x \) is a \((p \times 1)\) vector of observed variables, \( \Lambda \) is a \((p \times k)\) matrix of factor loadings, \( f \) is a \((k \times 1)\) vector of latent factors and \( e \) is a \((p \times 1)\) vector of residuals or measurement errors (see Jöreskog and Sörbom, 1979, for a more detailed description of this model). The measurement model relies on the estimation of factor loadings or \( \lambda \) weights.
to specify the epistemic correlation between the latent factor and the observed value of x. Factor analysis associates the indicators with high intercorrelation to a common factor. In the situation where there is a low to moderate association between indicators of a multidimensional concept, the indicators will not have high factor loadings on their concept. This will translate into high estimates of measurement error $\hat{\theta}$, low estimates of true variance ($\hat{\phi}$) and high residual values in the $S-E$ matrix which is the basis of the chi-square test of the overall goodness-of-fit of the model. In this situation, the LISREL model will yield a poor fit to the data. The poor fit would be misleading in the case where the separate indicators have low intercorrelation but have a high composite reliability using equation 1. Jöreskog (1971) indicates that the reliability of any given indicator can be estimated from the LISREL estimates by the formula:

$$\hat{\rho} = \frac{\hat{\phi}_{11}}{\hat{\phi}_{11} + \hat{\theta}}$$

(9)

in the situation where the $\hat{\lambda}$ value is unity by estimation or by constraint. Otherwise, the following formula should be used.

$$\hat{\rho}_1 = \frac{\hat{\lambda}_1^2 \hat{\phi}_{11}}{\hat{\lambda}_1^2 \hat{\phi}_{11} + \hat{\theta}_{11}}$$

(10)

Note that both of these formulae essentially restate the ratio expressed in equation 3. Mare and Mason (1980) and Corcoran (1980) utilize this approach, with some variations, in estimating the reliability of measures from multiple groups. The crucial aspect of equations 9 and 10 is that $\hat{\phi}_{11}$ will be underestimated under the conditions described above and $\hat{\theta}$ will be overestimated. This could be borne out by comparing the reliabilities estimated using established scales for each of the separate measures.
Therefore, under the conditions of low intercorrelation for the separate dimensions of a multidimensional concept the congeneric measurement model is inappropriate for estimating structural parameters. This is supported by classical test theory which assumes that the indicators of a concept have an underlying commonality such that a common factor (the concept) can be derived which exemplifies a unity intercorrelation between the true score variances in the measurement equation for each indicator of the concept (Jöreskog, 1971). The underlying commonality would be very low in the situation where there is a low intercorrelation between indicators.

Since the LISREL estimated reliabilities of the separate indicators will be lower than what you would anticipate when you are using established scales for the indicators or when you use some other methods of estimation, the researcher should, as Jöreskog (1971:112) suggests, "combine some of the tests into a linear composite to increase reliability." One technique that could be used to estimate the reliability of the linear composite is given in equation 1. Jöreskog specifies a different approach based on weighting the indicators by values proportional to the inverse of their error variance. Conger (1980) develops this weighting approach for unidimensional scales, but its usefulness for multidimensional scales is very limited.

If equation 1 is used to estimate the reliability of the linear composite, you could standardize the measures, then weight the standardized scores or allow the items to weight according to their variances. The main parameter which will influence the reliability of the composite will, of course, be the reliabilities of the measures. Jöreskog’s (1971:112) formula is given below.
\[
\rho = \frac{(a' \beta)^2}{(a' \beta)^2 + a' \Theta^2 a}
\]

where

\[a = (a_1, a_2, \ldots, a_m)\] are relative weights

\[\beta = \text{covariance matrix of the observed score and the true score variance}\]

\[\Theta^2 = \text{covariance matrix of measurement error variances}\]

Note that if the weights \((a')\) are the inverse of the measurement errors then this ratio will be very similar to the estimated reliability found by using equation 1. The main difference is that you will not have to estimate the \(\beta\) matrix or the \(\Theta\) matrix when you use equation 1. In fact, the application of equation 1 to the LISREL model is very straightforward.

First, the researcher establishes the reliabilities of the separate measures of the multidimensional concept. This can be done by using an outside criterion or by using an internal consistency approach such as coefficient alpha when you have a scale or multiple indicators of the dimension.

Second, estimate the reliability of your linear composite using equation 1. Third, calculate the variance of the composite variable and estimate its true variance and error variance. Equation 3 will provide the true and error variance estimates according to classical measurement theory.

Finally, the estimated true score variance may be entered into the true score covariance matrix and the measurement error variance can be entered into the appropriate measurement error matrix in LISREL. The lambda weight for the composite would be set to unity. This specification will result in a zero value in the associated cell of the S - Sigma matrix.

This approach can also be applied to other methods of structural equation models. The composite variance and the measurement error
variance values can be used in the errors-in-variables procedure to estimate structural parameters (see Fuller, 1971, 1975; Hidiroglou et al., 1979; and Warren et al., 1974). In this method, congeneric measurement models are not normally applied in estimating true and error variances. It is based on weighted least squares or errors-in-variables regression techniques for estimating structural parameters. This method has the advantage of being applicable under a variety of survey designs including multistage stratified samples.

Path analysis based on ordinary least squares regression can also be facilitated by using equation 1. Where block recursive models would have been employed one can now justify the use of a linear composite measure for the multidimensional concept. The higher estimate of reliability will substantiate the use of the composite in a path model. This would facilitate the derivation of a single estimate of the structural parameters rather than using block models and MPC coefficients or multiple tests for the direction and significance of a given path.

Conclusion

In this paper, a method for estimating the reliability of a multidimensional composite has been reviewed and developed. Its appropriateness and application potentials have been explored in the context of Jöreskog’s LISREL method, Fuller's errors-in-variables method and in conventional path analysis. This greatly expands the usefulness of multidimensional concepts for research purposes. Social indicator research should be a primary beneficiary of the reliability estimation approach developed in this paper, but its applicability is certainly not limited to this area. For instance,
in the sociology of the family, attempts are often made at measuring family education, family attitudes or family happiness using scores derived from individual members of the family. The perceptions and attitudes of the separate members may not be highly intercorrelated even though there is strong theoretical justification for combining these scores into an overall measure of the concept. The approach developed here would facilitate the formation of a reliable composite measure which could be used in a structural equation model.
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SECTION III. DEVELOPMENT OF AN AXIOMATIC THEORY OF ENVIRONMENT/ORGANIZATION INTERACTION:
A THEORETICAL AND EMPIRICAL ANALYSIS
Development of an axiomatic theory of environment/organization interaction: a theoretical and empirical analysis

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What is the impact of perceived environmental uncertainty on organizational processes and on organizational goal attainment? This paper is designed to answer this question by drawing out a set of theoretical statements from the organizational environment literature and the compliance theory literature which are empirically tested using a data set of 99 County Extension offices in Iowa. The ultimate goal of this paper is to develop a theory of environment/organization (E/O) interaction focusing on the effect of perceived environmental uncertainty on organizational structures and processes. The theory will be developed utilizing axiomatic theory building techniques (Hage, 1972; Zetterberg, 1965), and inductive path analytic techniques. The theory building process will involve two steps. First, the major theoretical concepts will be identified and defined through a review of the literature. Second, a set of theoretical statements will be identified and analyzed for theoretical and operational linkages. The theory will then be evaluated, first using bivariate correlational techniques, and second, using Jöreskog's confirmatory factor analytic method of path analysis. The latter method will provide an overall test of the goodness-of-fit of the theory to these organizations.

The Major Theoretical Concepts

Hage (1972:9) identifies two major kinds of theoretical concepts. Those which label categories or classes of phenomena and those which label dimensions of phenomena, either variable or nonvariable. In this section, the literature on E/O interaction will be reviewed with the goal of
identifying the general variable dimensions of E/O interaction. These variable concepts will serve as the building blocks for an axiomatic theory of E/O interaction.

Does any organization exist totally independent of external "environmental" influences? The answer to this question may seem obvious, but it is interesting to note how many of the major organizational models have ignored E/O interaction. Hass and Drabek (1973) present an analysis of the eight major complex organization models including the Weberian, human relations and the scientific management models. They find that only the open system model offers an adequate analysis of E/O interaction.

Despite this oversight in the conceptual development of organization theory, recent literature reveals a surge of interest in E/O interaction (e.g., Emery and Trist, 1963; Lawrence and Lorsch, 1967a, 1967b; Nebeker, 1975; Nystrom, 1974; Osborn and Hunt, 1974; Pennings, 1975; Terreberry, 1968; Tosi et al., 1973).

One of the first studies to analyze E/O interaction was conducted by William Dill (1958). He related environmental factors to organizational structure and participant behavior. The study involved an analysis of two Norwegian firms and found that "the autonomy of managerial personnel—their decisions for and against independent action—may be influenced by the structure of the environment, and by managerial perceptions of the meaning of environmental information" (Dill, 1958:23).

Thompson and McEwen (1958) in another early study point out the interdependence of complex organizations within the larger society. They treat other organizations as the focal organization's environment and propose that:
. . .because the setting of goals is essentially a problem of defining desired relationships between an organization and its environment change in either requires review and perhaps alteration of goals. . .reappraisal of goals is a more constant problem in an unstable environment than in a stable one (Thompson and McEwen, 1958:256).

These studies suggest three aspects of E/O interaction, the structure of the environment, the flow of information from the environment to the organization, and the degree of certainty that can be attributed to the information. These aspects of E/O interaction provide a useful framework for identifying general variable concepts.

Structure of the Environment

The structure of the environment has been analyzed from a number of different perspectives. The first perspective has to do with how individuals in an organization might perceive the environment (Aldrich, 1975; Duncan, 1972; Emery and Trist, 1963; Terreberry, 1968). Aldrich offers seven dimensions of the environment which summarizes this literature:

1. Its stability or instability in terms of the degree of turnover of elements in the environment.

2. Its homogeneity or heterogeneity in terms of the degree of similarity among the population to be dealt with, both individual and organizational.

3. Its concentration or dispersion in terms of the degree to which the population dealt with is distributed across the range of the domain of the organization.

4. Its environmental capacity in terms of the level of resources available to the organization.

5. Its domain consensus in terms of the degree to which the organization's claim to its domain is disputed or recognized by other organizations.
6. Its turbulence or placidity in terms of the extent to which the environment is disturbed or changed by other external activities.

7. Its mutability or immutability in terms of the extent to which the environment is open to change or manipulation by the organization (Hall, 1977:312).

All seven of these dimensions might provide useful general concepts, but not all of these dimensions have been examined empirically. Another perspective on the structure of the environment divides it into the general environment and the specific environment (Hall, 1972). According to Hall's breakdown the general environment is composed of:

1. Technological Conditions
2. Legal Conditions
3. Political Conditions
4. Economic Conditions
5. Demographic Conditions
6. Ecological Conditions
7. Cultural Conditions

These are broad spectrum conditions and although they should be considered in E/O interaction they do not provide us with general concepts useful to this analysis, but rather provide a general background in which an organization exists. These factors will place limits on the types of organizations which will come into existence as well as on the distribution and number of organizations which exist in any particular social cultural system (Azumi, 1972).

Hall's specific environment relates to the area of interorganizational relations. It is composed of the organizations and individuals with which an organization is in direct interaction. This literature has either focused on analyzing the characteristics of organizations which compose an organizational set (Aiken and Hage, 1971; Paulson, 1974), or upon interorganizational exchange in the form of coordination or conflict
(Assael, 1969; Klonglan et al., 1973; Litwak and Hylton, 1962; Mulford and Mulford, 1977). The general concept of interorganizational coordination and conflict can be added to the previously identified general concepts of environmental structure.

Flow of information

The flow of information into an organization has been particularly emphasized by the open systems theorists (Azumi and Hage, 1972; Berta-lanffy, 1968; Buckley, 1967; Hall and Fagen, 1968; Nystrom, 1974). Feedback is the concept used to describe the flow of information into an organization. It can vary by amount or by quality, and in an increasingly turbulent environment it plays a crucial role in organizational survival. Feedback provides an organization with an institutionalized flow of information concerning the status of the environment. It therefore acts as a channeling device through which the organization sees the environment.

Degree of uncertainty

The next aspect of E/O interaction relates to the degree of uncertainty an organization has about its environment. The uncertainty is often termed environmental uncertainty and may be conceptualized in two ways. The first conceptualization has to do with specific objective characteristics of the structure of the environment which may cause organizational members to not be able to predict specific changes in the environment which will influence the organization (Emery, 1965; Terreberry, 1968). This environmental uncertainty may be brought about by the structure of the environment or due to a lack of adequate information
concerning the environment. Various researchers have used the concept environmental uncertainty and generally they define it in the same way. Pekar (1976:15) defines it as "the predictability or likelihood that a particular event or occurrence will meet plan objectives." Nystrom (1974) defines it as a situation where probabilities cannot be estimated. Another way to conceptualize environmental uncertainty relates to a definition proposed by Nebeker (1975:282):

Perceived environmental uncertainty refers to the difficulty an individual has in deciding what is the most appropriate action—which choice will bring about the overall best results. Faced with a decision between two or more alternatives, the individual who perceives the environment as uncertain will have a difficult time choosing between them.

Notice that this definition introduces a more personal social psychological element to the concept. Perceived uncertainty relates to the actual perception of the structure of the environment and the adequacy of the flow of information into the organization. Perceived environmental uncertainty is, therefore, more a characteristic of key decision making individuals within an organization rather than a characteristic of the environment (Duncan, 1973; Downey, 1975a, 1975b; Nebeker, 1975). It would also appear that perceived environmental uncertainty should be related to the structure of the environment to the extent that perceived uncertainty could be measured by asking decision makers to describe dimensions of the environment on a scale from certain to uncertain. According to Nebeker's (1975) definition of perceived environmental uncertainty, those decision makers who perceive environmental dimensions as uncertain will have the highest degree of perceived environmental uncertainty.
Those two approaches to conceptualizing environmental uncertainty have not been clearly distinguished in the literature. It would seem appropriate to refine our conceptualization of environmental uncertainty into two distinct concepts, environmental uncertainty and perceived environmental uncertainty. Further, it would appear that perceived environmental uncertainty would have the most direct impact on organizational structure and processes since it is the perception of environmental uncertainty that would influence key decisions in organizations rather than environmental uncertainty which is not perceived.

This concludes the analysis of general E/O interaction concepts. The concepts which have been identified fit Hage's definition of the most useful type of concepts to begin with in developing an axiomatic theory. In the next section a set of theoretical statements will be developed which will serve as postulates for deriving corollaries.

General Theoretical Propositions

Hage notes that the most useful theoretical statement is the continuous theoretical statement. These are composed of variable concepts and specified linkages which take the form of "the greater the A, the greater the B." Propositions of this type can be derived from the wealth of current research on E/O interaction. Some of these findings are presented below. They are organized according to the interaction of the structure of the environment, perceived environmental uncertainty and the structure and process of organizations.
Environment—uncertainty

There have been a number of studies which examined the relationship between the environment and uncertainty. These studies have involved both theoretical and empirical research. In one of the major theoretical analyses of E/O interaction, Terreberry (1968) proposed that a high degree of environmental turbulence produces a high degree of perceived environmental uncertainty in organizations. Duncan (1973) found that organizations in both dynamic and complex environments have the greatest amount of perceived environmental uncertainty. Lawrence and Lorsch (1967a) found that organizations varied based on the rate of change in their environment, time span of definitive feedback, and degree of environmental uncertainty. These studies seem to indicate a rather clear relationship between the structure of the environment and perceived uncertainty, but other studies have found conflicting results.

In a more recent empirical analysis which attempted to test some of the earlier findings, Pennings (1975) found that perceived environmental uncertainty was positively and significantly related to environmental instability and competitiveness, but he also found that it was not significantly related to seven other environmental dimensions including complexity (both subjective and objective), feedback, and resource availability. Tosi et al. (1973) also found conflicting results when they subjected the measures of Lawrence and Lorsch to analysis using objective measures of environmental dimensions. Downey et al. (1975b) found that cognitive process variables rather than perceived environmental dimensions were more strongly related to perceived uncertainty. The literature on
Environment—Uncertainty appears to be ambiguous, but it is certain that perceived environmental uncertainty is related to some dimensions of the environment. Further research is needed to identify those crucial dimensions and show their interrelationship to the subjective characteristics of organizational members.

**Perceived uncertainty—organization structure and process**

Some studies have looked at the direct relationship between perceived environmental uncertainty and organization structure and process. Schmidt and Cummings (1976) found a significant relationship between perceived environmental uncertainty and organizational differentiation. Keller, Slocum and Susman (1974) found that organizations operating under conditions of high uncertainty would exhibit less formal hierarchy, a higher degree of emphasis on group decision making and a lower degree of emphasis on organizational rules. The degree of differentiation and integration in organizations were found to be contingent on the level of environmental uncertainty in a study by Lawrence and Lorsch (1967a). Pennings (1975) looked at the effect environmental uncertainty had on a variety of organization structure variables. He found that environmental uncertainty had no significant impact on structural variables. These variables included communication, participativeness and power but they did not include some of the previously mentioned variables such as centralization, differentiation, and formalization. Here again the findings are somewhat ambiguous and further analysis would be in order.
Other studies have shown the direct relationship between the environment and the structure and processes of an organization. As noted earlier, Thompson and McEwen (1958) found that the greater the instability of the environment, the greater the number of alterations in organizational goals. Organizational goal alterations relates to Hage's concept of organization adaptability. Osborn and Hunt (1974) found that as the environment becomes more complex, the organization must adjust internal structures and processes to maintain or increase effectiveness. Other researchers have found environmental complexity to be positively related to organizational flexibility, decentralization, participation in decision making and lower formalization (Bennis, 1966; Burns and Stalker, 1961; Lawrence and Lorsch, 1967a, 1967b). Becker and Gordon (1965) found a similar relationship between environmental complexity and decentralization. They also found that the rapidity of response and the heterogeneity of the environment leads to decentralization.

The review of the literature presented above leads us to the development of several general propositions, but before identifying these propositions it is important to consider the nature of the relationships presented above. Generally the relationships could be described as continuous, in Hage's sense, but for the most part they do not imply a causal relationship. Notable exceptions are Becker and Gordon (1965) and Paulson (1974). Although the relationships are not stated in a causal sense, the discussions contained in the articles often tended toward this interpretation. Costner and Leik (1964) have shown the utility of causal thinking in making deductions in axiomatic theory. They indicate that the sign
rule, which is normally employed in deriving propositions, does not produce reliable deductions unless the correlations between the concepts are very high or other strict conditions are met. The sign rule is based on the premise that the general propositions have symmetrical linkages.

Zetterberg (1965) classifies these linkages as reversible. Using the sign rule if \( A \rightarrow B \) and \( B \rightarrow C \), then \( A \rightarrow C \), you just add the signs up to derive the sign of \( A \rightarrow C \). Costner and Leik (1964) prove, by using partial correlation analysis, that a set of sufficient conditions (that is, regardless of the magnitude of the correlations) for the validity of the sign rule is, if:

1. postulates are stated in asymmetric causal form;
2. the common variable in the two postulates is prior to one but not to both of the other two variables; and
3. a "closed system" is assumed, i.e., it is assumed that there is no connection between the variables in the postulates except those connections stated or implied in the postulates.

If the above theoretical linkage is not specified, the relationships between \( A \rightarrow B \), and \( B \rightarrow C \) have to be very high as depicted in the diagram below.

![Diagram](image-url)

Figure 1. High intercorrelation range diagram
The magnitude of the correlations would have to be in the shaded areas; otherwise the relationship between A and C would not hold. Without going into a further explanation of Costner and Leik's analysis, suffice it to say that it would prove very useful if the linkages met the criterion stated above. In Hage's (1972) axiomatic theory of organizations, the propositions were not stated in a causal form. His emphasis was upon developing all possible propositions, and he was not concerned with the validity of the propositions. He left this up to empirical analysis.

Nonetheless, Hage does not reject the notion of causality and he even encourages searching the literature for intervening causal variables (Hage, 1972:93). It appears from the research presented above that environmental uncertainty does play the role of an intervening causal variable in the relationship between the environment and the structure and processes of an organization. This is a relationship which seems to be intuitively acceptable, but it could be subject to empirical verification utilizing partial correlation analysis as suggested by Costner and Leik (1964) or more appropriately using partial regression analysis as suggested by Blalock and Blalock (1968).

Theoretical Statements

In view of the above discussion, it would seem advantageous to establish a temporal or causal ordering of the major concepts which will be examined in this paper. The underlying relationship is that perceived environmental uncertainty is influenced by objective external dimensions of environmental uncertainty and, in turn, perceived environmental uncertainty effects a variety of organizational structure and process variables.
The theoretical linkage between these concepts can be specified by three general premises. First, the environment of an organization will impact an organization if the organization is an open system, which most, if not all, organizations are. Second, the organization perceives the environment, and interprets the environment in relation to the organization's goals, by the degree of unpredictability it encounters when making decisions related to the organization's goals, be they either formal or informal. This premise is crucial in that it emphasizes the importance of perceived environmental uncertainty. The perception of uncertainty in environmental dimensions such as competition, environmental capacity and information flow provide the link between the objective external environment and the perceived external environment. The third premise is that the organization alters its structure and processes in order to deal with its perceived environmental uncertainty.

The final premise calls for an examination or identification of the specific structure and process dimensions which might be effected by perceived environmental uncertainty. A variety of these dimensions have been discussed, such as flexibility, differentiation, centralization, and ultimately, organizational effectiveness or goal attainment. Some further dimensions which might prove theoretically as well as empirically interesting are socialization, communication, tension and commitment. These latter dimensions as well as the dimensions of flexibility and goal attainment will serve as the major dimensions of structure and process examined here. These were selected because restrictions have to be imposed on the number of dimensions examined and because the dimensions of differentiation and centralization lack variance across County
Extension organizations. These organizations will serve as the unit of analysis for subsequent empirical analysis. Socialization, communication, tension and commitment have also been proven to be important dimensions of organizational structure and process in Etzioni's (1975) compliance theory and in the causal modeling research of Mulford et al. (1972). A specific causal or structural equation model will be examined in a later section which will build upon Etzioni and Mulford et al. by incorporating perceived environmental uncertainty into their theory of organizational behavior.

A general model of the interrelationship between these concepts should emphasize the temporal ordering of the concepts. The variables perceived environmental uncertainty, socialization and communication are proposed to be temporally prior to the other four variables flexibility, tension, commitment and goal attainment. Mulford et al. (1972) specified socialization and communication in a similar temporal ordering. Perceived environmental uncertainty may also be viewed as occurring prior to the four remaining structure process variables, according to the literature cited above. Note that if perceived measures were not employed for environmental uncertainty, then it might well be viewed as external to the organization and therefore precede socialization and communication in this ordering.

Commitment and tension have been identified by Etzioni as key process variables which are determined by socialization and communication (Mulford et al., 1972). Although the Mulford study does not use the concept of commitment, it seems to be highly related to scope, which is used. Commitment is defined as the intensity of positive involvement by an actor to an organization (Etzioni, 1975:9). The variable flexibility is not identified by Etzioni, but it was identified in the environmental
uncertainty literature. Flexibility represents the organization's ability to react to emergency situations and changes in routine. There is no evidence as to temporal placement of this component of an organization within the framework developed, so it will be assumed to enter at the same time as commitment and pervasiveness. The final variable, goal attainment, is a general measure of organizational effectiveness. Goal attainment is assumed to be produced by all of the preceding variables in interaction with one another.

**Empirical Analysis**

The purpose of this section is to analyze E/O interaction utilizing data generated in a study of County Extension organizations. This will provide a test of the theoretical relationships outlined above by operating the concepts and estimating their interrelationships.

**The data**

The data for this analysis come from a 1978 study of 99 county extension offices in the state of Iowa. Questionnaires were completed by the County Extension Directors (CEDs) in each county. The CEDs are the key decision makers in these organizations. It is their responsibility to see to it that organizational goals are met through organizational structures and processes. The variables are therefore subjective in nature and represent the perceptions of these key informants. The questions were asked in such a way that the responses should reflect a more generalized "organizational" opinion rather than idiosyncratic responses. Even so, there remains the question of whether an individual key decision
maker's response can be used as an organization response and whether perceived environmental uncertainty, the key variable in the study, can be considered as an organizational variable as opposed to an individual characteristic. The approach taken in this paper is to define all of the variables in the study as perceived variables, thereby accurately reflecting the subjective nature of the data.

The measures

Nine composite scales were developed from the data to represent possible components of E/O interaction. The composites and the reliabilities (alpha values) are presented in Table 1. Note that the dimensions are divided into perceived environmental dimensions, perceived structure and processes of the organization and perceived organizational goal attainment. Additionally, the number of indicators for each composite are given in parentheses. All the variables were measured using an 11 point Likert-type scale. See Appendix A for a listing of the items.

The environmental variables represent some of the major dimensions of environmental structure and feedback which have been previously identified. **Competition** measured the degree to which the County Extension Director (CED) believed his office was losing clientele and volunteer leaders to other organizations. **Environmental Capacity** measured the extent to which the CED believed his office had a sufficient amount of resources in terms of finances and equipment to fulfill its mission. **Information Flow** measured the degree to which the information the CED had was sufficient for decision making or allowed him/her to know what to expect in dealing with people or organizations in the county. It is
Table 1. Scales and reliabilities

<table>
<thead>
<tr>
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<tr>
<td>Competition (2)</td>
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<tr>
<td>Environmental Capacity (2)</td>
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<tr>
<td>Information Flow (3)</td>
<td>.62</td>
</tr>
<tr>
<td><strong>Perceived Organizational Structure and Process</strong></td>
<td></td>
</tr>
<tr>
<td>Socialization (2)</td>
<td>.65</td>
</tr>
<tr>
<td>Communication (2)</td>
<td>.81</td>
</tr>
<tr>
<td>Flexibility (1)</td>
<td>1.00</td>
</tr>
<tr>
<td>Tension (2)</td>
<td>.71</td>
</tr>
<tr>
<td>Commitment (3)</td>
<td>.83</td>
</tr>
<tr>
<td><strong>Perceived Goal Attainment</strong></td>
<td>.85</td>
</tr>
</tbody>
</table>

expected that these three variables will measure the level of perceived environmental uncertainty in the County Extension Organization (CEO).

Note that both the environmental capacity measure and the information flow measure were reverse coded such that a high score indicated high uncertainty on these dimensions. Socialization was measured by the CED's perception of the adequacy of job orientation and training. Communication was measured by the degree to which the extension staff interacted in their daily activities and exchanged information about what was going on in their program areas. Flexibility was measured by the extent to which the staff could adjust to changes in work routines. Tension was measured by the degree to which the staff feels pressured to work with clientele groups they would prefer not to work with or in program areas they would prefer not to work in. Commitment was measured as the extent to which the staff were willing to work overtime, felt a strong desire to meet the objectives of the County Extension Service, and exerted high levels of effort beyond minimal job expectations. Goal Attainment was measured by
the degree to which the quantity, quality and distribution of programs to
various clientele groups were consistent with the established goals.

Methodology

The empirical analysis will be divided into two parts. First, the
bivariate relationship between the nine variables will be examined by
deriving a corrected for attenuation correlation matrix. Note that since
reliability estimates are available for almost all of the variables it is
possible to correct for attenuation caused by random measurement error
(Bohrnstedt and Carter, 1971). Then, the perceived environmental uncer­
tainty dimensions will be combined into a composite scale which will be
correlated with the other variables to facilitate an examination of the
overall effect of the multidimensional measure of uncertainty on the
other variables.

The second part of the empirical analysis will focus on the construc­
tion of a structural equation model to examine the interrelationships of
perceived environmental uncertainty, organizational structure and process
and perceived goal attainment. The structural equation model will be
analyzed using Jöreskog's factor analytic technique of analysis of co­
variance structures (Jöreskog and Sörbom, 1978). This method of path
analysis is utilized. Due to the abstract level of the axiomatic theory
and the availability of multiple indicators of the latent variables in the
theory, the structure of the model will be somewhat based on the earlier
work of Mulford et al. (1972) and will include the multidimensional measure
of perceived environmental uncertainty as an exogenous variable. This
method will not only afford an examination of individual structural
relationships, but also will provide an overall evaluation of the goodness-of-fit of the model.

Findings

Table 2 contains the corrected for attenuation correlation matrix for the measured variables. Note that the separate measures of perceived environmental uncertainty tend to be very strongly associated with the measures of organizational structure and process. The highest of these associations is the relationship between information flow and socialization (r=−.74). This would indicate that as uncertainty regarding information received through normal channels increases, the usefulness or adequacy of job orientation and training declines. Obviously, it is very difficult to train people for job situations under conditions of uncertainty. Their training does not prepare them for dealing with inadequate flows of information. Communication is also significantly related to uncertainty regarding the flow of information (r=−.28). This would indicate that communication in these organizations is adversely affected by conditions of inadequate information flow. It appears that the staff tends to reduce interaction when they do not feel they have sufficient environmental information to pass along meaningful suggestions. Perceived competition produces a similar effect on the level of communication in these organizations (r=−.32). This may be a result of continued frustration in dealing with the rise of competing organizations. Some of these competing organizations are surely educationally oriented, but competition may also be found in social organizations and religious groups. As client and volunteer leaders are lost the overall level of an organization's
activity probably declines. In any case, as clients and volunteer leaders are lost there is evidence to suggest that the level of interaction between staff members declines.

Flow of information is also significantly negatively related to organizational flexibility (r=-.31). This finding runs contrary to the expected relationship found in the literature. These organizations do not exhibit increased flexibility under conditions of uncertainty, but rather uncertainty reduces their ability to adapt to changes in work routines. This is further supported by the negative association between competition and flexibility which also runs contrary to the literature cited earlier. Given the relationships presented above it is not surprising to find that all three uncertainty dimensions are significantly positively related to organizational tension (r values range from .30 to .51). This is a finding of major importance since organizational tension is also significantly related to goal attainment (r=-.23). As tension increases, goal attainment declines.

The perceived environmental uncertainty dimensions are not strongly related to organizational commitment with the notable exception of competition (r=-.30). Even so, all of the uncertainty dimensions are negatively related to this measure of commitment.

Given these findings, it is certainly not unexpected that all of the uncertainty dimensions are significantly negatively related to goal attainment. The magnitude of these coefficients (r's range from -.24 to -.45) definitely suggests that perceived environmental uncertainty is an important variable to consider in producing high levels of goal attainment. It is interesting to note that the weakest of these three
Table 2. Correlation coefficients corrected for attenuation

<table>
<thead>
<tr>
<th></th>
<th>$Z_1$</th>
<th>$Z_2$</th>
<th>$Z_3$</th>
<th>$Z_4$</th>
<th>$Z_5$</th>
<th>$Z_6$</th>
<th>$Z_7$</th>
<th>$Z_8$</th>
<th>$Z_9$</th>
</tr>
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<tr>
<td>$Z_1$ Env. Competition</td>
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<td>.26**</td>
<td>.50***</td>
<td>.11</td>
<td>-.32***</td>
<td>-.36***</td>
<td>.51***</td>
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<td>-.45***</td>
</tr>
<tr>
<td>$Z_2$ Env. Capacity</td>
<td></td>
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<td>.28**</td>
<td>-.33**</td>
<td>-.02</td>
<td>.00</td>
<td>.30**</td>
<td>-.10</td>
<td>-.24</td>
</tr>
<tr>
<td>$Z_3$ Information Flow</td>
<td></td>
<td></td>
<td>1.00</td>
<td>-.74***</td>
<td>.28**</td>
<td>-.31***</td>
<td>.34**</td>
<td>-.13</td>
<td>-.39***</td>
</tr>
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<td>$Z_4$ Org. Socialization</td>
<td></td>
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<td></td>
<td>1.00</td>
<td>-.00</td>
<td>.26**</td>
<td>.23*</td>
<td>.10</td>
<td>.33**</td>
</tr>
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<td>$Z_5$ Org. Communication</td>
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<td></td>
<td></td>
<td>1.00</td>
<td>.30***</td>
<td>.04</td>
<td>.48***</td>
<td>.23***</td>
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<td>$Z_6$ Org. Flexibility</td>
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<td></td>
<td>1.00</td>
<td>-.13</td>
<td>.34***</td>
<td>.12</td>
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<td>$Z_7$ Org. Tension</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>-.02</td>
<td>-.23**</td>
</tr>
<tr>
<td>$Z_8$ Org. Commitment</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>.19*</td>
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<td>$Z_9$ Org. Goal Attainment</td>
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</tr>
</tbody>
</table>

*Significant at .10.
**Significant at .05.
***Significant at .01.
coefficients is associated with environmental capacity. This underscores the importance of the more subjective measures of information flow and environmental competition.

It would appear from this preliminary analysis that the county Extension offices are not coping well with perceived environmental uncertainty, while the theoretical statements relating uncertainty to organizational structure and process tend to have the underlying assumption that the organization is adjusting well to conditions of uncertainty. One possible explanation for this inconsistency is that this underlying assumption does not apply to organizations of this type. Another explanation might be that county extension organizations are currently in a transition stage and have not yet reacted positively to the adverse effect of perceived environmental uncertainty. It is often said that adversity is the mother of invention.

Thus far, the dimensions of perceived environmental uncertainty have been measured separately. This has afforded a look at the individual impacts of the various dimensions on organizational structures and processes. Although this approach is useful it is limited in that it does not allow for a look at the comprehensive effect of perceived environmental uncertainty on these organizational variables. It would be useful to derive a single composite measure of perceived environmental uncertainty which encompassed all of the dimensions of this concept. One approach to forming a single composite measure is to combine the three dimension scores into a composite score by summing the measures and deriving the average for these scales. This procedure was followed and coefficient alpha was calculated to estimate the reliability of the composite.
Unfortunately, the reliability for the composite was calculated to be .42 which is certainly too low of an estimated reliability to justify creating a composite measure. It might be noted that the means for the separate scales were not significantly different from one another at the .05 level of significance and the variances were quite similar. Further, the theoretical rationale for combining these measures is quite strong recognizing the multidimensional character of the concept and that the reliability estimates from the separate scales were quite high.

The difficulty here lies in the fact that multidimensional scales have to be treated differently from unidimensional scales when estimating reliability. Nunnally (1978) describes an approach for estimating the reliability of a linear composite when the measures are taken from different sampling domains. Ganey (1981) further develops this approach for multidimensional concepts and shows its utility for structural equation modeling. This approach essentially weights the reliability estimate primarily by the reliabilities of the separate measures and secondarily by their variances and intercorrelations. Given the relatively low intercorrelation between the measures of perceived environmental uncertainty, this appears to be the proper route for estimating the reliability of this composite measure. The equation for estimating the reliability is given below.

\[ \hat{r}_{YY} = 1 - \frac{\sum \sigma_i^2 - \sum r_{ii} \sigma_i^2}{\sigma_Y^2} \]  

(1)

Note that you must be able to supply the reliability estimates for the separate scales in equation 1 in order to use this formula.
Fortunately, this is possible given the multiple indicators used for measuring each dimension. Using this approach the estimated reliability of the composite is .76 which is well within the range of acceptability for using this scale in further analysis.

Table 3 contains the corrected for attenuation correlation coefficients for the composite measure and the structure and process variables. These results are consistent with the separate dimension correlation findings.

Table 3. Composite perceived environmental uncertainty correlations corrected for attenuation

<table>
<thead>
<tr>
<th>Socialization</th>
<th>Communication</th>
<th>Flexibility</th>
<th>Tension</th>
<th>Commitment</th>
<th>Goal Attainment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Environmental Uncertainty</td>
<td>-.46***</td>
<td>-.24*</td>
<td>-.27**</td>
<td>.53***</td>
<td>.24*</td>
</tr>
</tbody>
</table>

*Significant at .05.
**Significant at .01.
***Significant at .001.

Note the very strong negative relationship with socialization (r=-.46) and goal attainment (r=-.47) and the strong positive association with tension. Perceived environmental uncertainty is significantly related to all of the structure and process dimensions at the .05 level of significance. This clearly documents the importance of perceived environmental uncertainty in the functioning of these organizations.

The next step in the data analysis involves using structural equation modeling techniques. The goal of this section is to apply the prior theoretical discussion to a more complex analysis of the organizational system. The variables which are available will provide a basis for
an overall evaluation of the theory. The multivariate nature of the theoretical discussion can only be appropriately evaluated using a multivariate method of analysis. This approach should provide a more realistic assessment of the effects of perceived environmental uncertainty on the organizational system since all of these variables are in a constant state of interaction within an organization.

Figure 2 displays a structural equation model which is consistent with the previously described temporal ordering of the variables. The model was estimated using the LISREL IV computer program (Jöreskog and Sörbom, 1978). The Ksi (ξ latent independent variables) and Eta (η latent dependent variables) are defined as follows.

\[
\begin{align*}
\text{Ksi 1} & = \text{Perceived Environmental Uncertainty} \\
\text{Ksi 2} & = \text{Socialization} \\
\text{Ksi 3} & = \text{Communication} \\
\text{Eta 1} & = \text{Flexibility} \\
\text{Eta 2} & = \text{Tension} \\
\text{Eta 3} & = \text{Commitment} \\
\text{Eta 4} & = \text{Goal Attainment}
\end{align*}
\]

The indicator weighting estimates (lambdas) and the indicator measurement error estimates (theta deltas-independent, theta epsilon-dependent) are presented with their standard errors in Table 4. The unstandardized and standardized (in parentheses) gamma, path coefficients, are given in Figure 2 along with the specification error, zeta, coefficients. Additionally, the estimated true variances for the Eta and Ksi factors are given in their respective circles.

Indicative path analytic techniques were employed to derive a model consistent with the temporal ordering and the past research. The chi square test of significance for this model (p=.18) indicates that the model fits the data very well. The chi square probability should be
Figure 2. Structural equation model

*significant at .10
**significant at .05
***significant at .01
Table 4. Parameter estimates and standard errors for lambdas, theta deltas, and theta epsilons

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Maximum Likelihood Estimate</th>
<th>Standard Error</th>
<th>Parameter</th>
<th>Maximum Likelihood Estimate</th>
<th>Standard Error</th>
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</table>

\(^a\)Indicates a fixed value.

greater than .10 to conclude that the estimated covariance structure of the model is not significantly different from the observed covariance structure the \( R^2 \) values for the various structural equations indicate that some other variables might be added to this model to improve the explained variance.

All the measurement models are based on the congeneric model except the models for perceived environmental uncertainty and flexibility. Flexibility is measured by a single indicator so it is assured to have no measurement error. Perceived environmental uncertainty has a fixed measurement error and true variance based on its estimated reliability. An examination of the path coefficients reveals that perceived environmental uncertainty has significant direct effects on socialization (\( p = -.22 \)), tension (\( p = .51 \)) and goal attainment (\( p = -.40 \)). It is the only exogenous
variable which is related to tension. Note that none of the endogenous variables are related to goal attainment after the exogenous variables are entered in the model. It is particularly interesting that tension is not significantly related after the direct effects of perceived environmental uncertainty and socialization are taken into consideration. The significant positive direct effects of communication on flexibility (p=.28) and commitment (p=.48), and socialization on goal attainment (p=.24) show that these exogenous variables have a strong positive effect on organizational structures and processes.

Conclusion

The goal of this paper was to develop a theory of E/O interaction. An axiomatic theory was developed. This theory originally appeared to be very broad in scope in that it was applicable to all organizations which can be categorized as open systems. It was found through the empirical analysis that the theory may be appropriate only for organizations which are coping well with conditions of uncertainty. The theory is restricted to the extent that it did not cover all of the dimensions of perceived environmental uncertainty and it did not allow for two-way causation.

The theory is rather parsimonious considering the causal nature of the general propositions. If the author had relied upon the more traditional interpretation of the sign rule more propositions could have been derived. The author feels that if one is engaged in the process of theory construction in a relatively new area it does more good to draw all available information together, and then derive the tightest theory
possible, thereby making a statement of the current knowledge we have in this area, which will serve as a building block for future researchers, rather than deriving all possible combinations of concepts.

Another aspect of the parsimony of the theory has to do with its evaluation. The theory is built on the intervening concept of perceived environmental uncertainty. A test of the theory is available by utilizing the methods specified by Costner and Leik (1964).

The results of both the bivariate and multivariate analysis clearly indicate that perceived environmental uncertainty is a major variable that should be taken into consideration as a determining factor when developing models of organizational structure and process. It would also be useful to consider developing models which contain measures of objective environmental uncertainty external to the organization. Objective measures of competition, environmental capacity and the other dimensions of environmental uncertainty should be related to the internal concept of perceived environmental uncertainty according to the literature and the theory.

Data were presented to directly test the theoretical statements and the principles of the theoretical linkages were examined. The theory was not fully supported by this analysis. It is suggested that the theory may only be appropriate for organizations which are coping well with conditions of uncertainty, and the county Extension offices do not appear to be in this category. Another factor which should be considered before rejecting the theory is that objective measures of such variables as centralization, differentiation and formalization were not available for these organizations due to a high degree of homogeneity. It would not be appropriate to reject the theory on the basis of analysis using
expedient variables. Further analysis using a different population of organizations would be enlightening.
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APPENDIX A. MEASUREMENT OF THE CONCEPTS

Environmental Competition
1. Is your County Extension Service losing clientele because other organizations in the county are providing similar educational programs?
2. Is your County Extension Service losing volunteer leaders to other organizations in the county?

Environmental Capacity
1. Does your County Extension Service have a sufficient amount of finances to fulfill its mission?
2. Does your County Extension Service have a sufficient amount of equipment to fulfill its mission?

Information Flow
1. How often do you believe that the information you have about your county is sufficient for decision making?
2. How often do you believe that the information you receive from area and state Extension staff is sufficient for decision making?
3. How often do you know what to expect in your dealings with other people or organizations in the county?

Socialization
1. Is the orientation provided to new Extension Service field staff rather inadequate, adequate or more than adequate?
2. Is the staff training for updating skills and abilities and for informing field staff about new goal priorities and new procedures rather inadequate, adequate or more than adequate?

Communication
1. To what extent do staff members in your County Extension Service exchange information about what is going on in their program areas?
2. To what extent do staff members in your County Extension Service interact with each other in their daily Extension activities?

Flexibility
1. Do staff members in your County Extension Service readily accept and adjust to changes in their work routine?
Tension

1. Do staff members in your County Extension Service feel pressured to work on programs that they would prefer not to be involved in?

2. Do staff members in your County Extension Service feel pressured to work with clientele groups that they would prefer not to work with?

Commitment

1. Do staff members in your county exhibit a willingness to work over-time?

2. Do staff members in your county exhibit a strong desire to meet the objectives of the County Extension Service?

3. Do staff members in your county exert high levels of effort on behalf of the County Extension Service beyond minimal job expectations?

Goal Attainment

1. Based on your county goals, to what extent is the quantity (number) of programs provided to clientele groups consistent with your county goals?

2. Based on your county goals, to what extent is the quality (how good) of programs provided to clientele groups consistent with your county goals?

3. Based on your county goals, to what extent is the distribution of programs to various clientele groups consistent with your county goals?
SUMMARY AND DISCUSSION

This research examines the relationship between organizations and their environments. It particularly focuses on the concept of environmental uncertainty. This concept is shown, through a review of the literature, to be a critical concept in mediating the relationship between organizations and their environments. Three specific objectives of the research were to (1) examine the historical social science literature on the effects of environmental dynamics on social units, (2) examine and resolve the methodological problems associated with empirically assessing the impact of a multidimensional concept on other variables and (3) develop and empirically evaluate a theoretical model of the effects of perceived environmental uncertainty on organizational structures and processes.

The first paper in this dissertation draws together the historical social science literature on the subject of environmental dynamics and their effect upon social units. This section clearly documents that environmental dynamics have been incorporated into the social philosophies and theories of many of the classical social thinkers. Further, it is possible to document a progression of thought beginning with the environmental determinism of Hippocrates, Plato and Aristotle. These social philosophers used the individual as their unit of analysis and conceptualized the environment as either physical or political in nature. The Enlightenment philosophers Hobbes, Montesquieu and Rousseau advocated the development of a rational powerful state to bring order and stability to an otherwise unstable environment and thereby free men to engage in the higher pursuits of philosophy, exchange and the arts. At this stage it
might be noted that Hobbes uses the particular term "uncertain" to refer to the environment, and uses economic organizations as a unit of analysis, as well as the individual and society in general. The nineteenth century social philosophers Marx, Spencer, Durkheim and Weber followed the progression to higher level units of analysis with Marx, Spencer and Durkheim focusing on society and Weber focusing particularly on organizations. They all appreciated the idea of an unstable changing environment. They strongly supported the notion that it was the social environment and not the physical that was most important in human, societal and organizational development.

The second objective of this research was to examine and resolve the methodological problems associated with multidimensional concepts. The second paper addresses this objective. A major problem associated with empirically dealing with multidimensional concepts is that, if the separate dimensions are drawing from different sampling domains, they will not form a reliable composite using conventional methods for reliability estimation. This problem is not limited to the concept of environmental uncertainty, but rather, is a generalized situation found for many social science concepts, particularly social indicator concepts. A specific step-by-step procedure was developed in the second paper for applying a relatively unknown psychometric technique to Joreskog's confirmatory factor analysis method as well as the errors-in-variables method and least squares regression.

The third objective was to empirically evaluate a theoretical model of the effects of perceived environmental uncertainty on organizational structures and processes. Axiomatic theory building techniques were used
in the third paper to show that external environmental uncertainty, found in a variety of environmental dimensions, produce a perception of uncertainty in organizational members, particularly elite members. In turn, these perceptions of uncertainty effect specific structure and process dimensions of organizations. The theoretical relationships between perceived environmental uncertainty and the structure and process of organizations are examined empirically in 99 County Extension organizations in Iowa. The bivariate and multivariate analysis shows the importance of perceived environmental uncertainty in determining the structure and process dimensions of these organizations. It is also found that these organizations are not coping particularly well with uncertainty. Perceived environmental uncertainty has a negative effect on the organization's flexibility and goal attainment, and has a strong positive effect of increasing tension in these organizations.

The interaction of organizations and their environments is, therefore, shown to be an important theoretical and empirical dimension of sociological inquiry. It merits further research on both of these levels. Further theoretical research may build on the theoretical treatment given here and further empirical analysis can be facilitated and guided by the techniques and findings presented in this research.
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A dissertation and graduate study always involves family sacrifices and frustrations. My wife, Carol, and my sons, John and Ben, have had to endure the brunt of these sacrifices and frustrations. Their support and encouragement has never faltered over the years despite these hardships.

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