DOCUMENT RESUME

ED 336 011 HE 024 831

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TITLE Science and Institutional Research: The Links. AIR 1991 Annual Forum Paper.
PUB DATE May 91
NOTE 22p.; Paper presented at the Annual Forum of the Association for Institutional Research (31st, San Francisco, CA, May 26-29, 1991).
PUB TYPE Speeches/Conference Papers (150) -- Viewpoints (Opinion/Position Papers, Essays, etc.) (120)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cognitive Structures; Higher Education; Inquiry; *Institutional Research; Models; Politics of Education; *Research Methodology; *Scientific Attitudes; Scientific Enterprise; *Scientific Methodology
IDENTIFIERS *AIR Forum

ABSTRACT

This paper compares the process and structure of institutional research with three ways of conceptualizing science. The first section examines the scientific method as a process of disciplined inquiry, then compares institutional research to that process. The second section compares the logical structure of institutional research with the logical structure of scientific inquiry. The third section utilizes Thomas Kuhn's notion of scientific paradigms to examine the community of institutional researchers. Institutional research is seen to share many elements of science, though differing in purpose. The paper concludes that the dynamic nature of institutional research demands frequent shifts in the process of pattern identification, especially in light of the dependence of institutional research upon the politics of higher education and the social goals of governments and communities. Includes 14 references. (DB)

Science and Institutional Research:

The Links

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for Management Research, Policy Analysis, and Planning

This paper was presented at the Thirty-First Annual Forum of the Association for Institutional Research held at The Westin St. Francis, San Francisco, California, May 26-29, 1991. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum Papers.

Jean Endo
Chair and Editor
Forum Publications Editorial
Advisory Committee

Abstract

Discussions of the functions of institutional research are common. However, discussions concerning the structures associated with disciplined inquiry, the *research* part of institutional research, have been rare. This paper compares the process and structure of institutional research with three ways in which science is conceptualized. These comparisons result in the recognition that although institutional research has much in common with science, it is distinct from science. This paper begins the process of identifying the structures and assumptions that form the basis of institutional research.

Institutional research is a term that is used in reference to a wide variety of activities ranging from data processing to disciplined inquiry. Several people have attempted to define institutional research—Maasen (1986) in terms of the main data handling activities; Peterson (1985) in terms of its linkages between institutions of higher education and the functions of higher education; Saupe (1981) in terms of its use in planning, policy analysis, and decision making. Definitions have failed to characterize important aspects of institutional research. "This...has become something of an embarrassment to those of us who have spent a number of years calling ourselves institutional researchers" (Muffo and McLaughlin,1987, p. iv). The attempts at definition fail to address the process and structure of the *research* part of institutional research.

An "ideal type" of disciplined inquiry has yet to be identified to guide the practitioner in doing institutional research. "Ideal type" is a term used by Max Weber (1949) to describe an abstract utopian construct that characterizes a set of relationships. "It is not a description of reality but it aims to give unambiguous means of expression to such a description" (Weber, 1949, p. 90). A logical structure or model would be an ideal type. Like a map, it communicates structural essentials, thus reducing ambiguity. Having an ideal type allows one to better know how to go about doing what needs to be done.

When one speaks of disciplined inquiry or research, the natural assumption is that one is talking about science. Science provides the ideal type that comes to mind when such things are discussed. For example, von Vught (1990) compared institutional research to science, and argued that institutional research faces legitimacy problems with the scientists that make up the academic community.

(Inherent in this argument is that institutional research should be compared to science, and in fact should be science.)

Upon reflection, we find at least three ideal types associated with science. The first is the structure of the process of modern science, usually referred to as scientific method. The second is the logical structure of science. This ideal type deals with scientific ways of thinking. The third ideal type is related to the social structure of science and the social elements that contribute to the growth and development of an understanding of a set of related phenomena.

This paper outlines the ideal types mentioned above and discusses institutional research's characteristics in relation to these structures of science. The first section of the paper examines scientific method as a process of disciplined inquiry, then compares institutional research to that process. The second section compares the logical structure of institutional research with the logical structure of scientific inquiry. The third section utilizes Thomas Kuhn's (1962) notion of scientific paradigms examine the community of institutional researchers. It is hoped that this discussion will lead to identification of ideal types in institutional research, dispelling misconceptions about the ' research" in institutional research and resulting in improvements in the quality of work done in the area.

SCIENTIFIC METHOD

Like institutional research, science as a form has itself defied simple definition. Philosophers of science have for centuries refined and reshaped the concept of science, and have argued about its features as a disciplined method of inquiry. At different times science has meant different things. It has undergone paradigm shifts — dramatic alterations of focus and perspective. With each shift, it

has incorporated earlier versions of science to some degree, but has taken a new approach in order to correct for weaknesses perceived in the previous paradigm. With each new approach, either the previous paradigms have been abandoned or they have been accepted as tools to be used in the quest for knowledge. In spite of the dynamic natures of science and institutional research, or perhaps because of them, science and institutional research have a great deal in common.

"Scientific Method" is a logical process with which institutional research shares several features. Scientific method consists of the following: observations, facts, hypotheses, experiments, theories and laws. The logical structure begins not with theories, but rather first with observations and facts (Casti, 1989). Observations are more than just catalogued events, they often include groupings of data. Observations are made that single pieces of data group in a way that suggests to the observer that the grouping is meaningful. Conjecture about the explanations for the patterns observed leads to hypotheses. Experiments are conducted to test the hypotheses. If a hypothesis is supported by the evidence, the identification of laws and theory building follow.

Institutional research follows a similar logical process. Observations and facts serve as the foundation for disciplined inquiry. Data and facts about the institution and about higher education are examined for patterns. It is the observers (which may include administrators and faculty, as well as the institutional researcher) who decide which information is relevant to the question at hand. The way in which the question is posed influences the understanding of what is relevant. The environmental factors that influence decision making also determine what is relevant. Pattern identification, the result of repeated observations in a

context created by fact, is an important part of institutional research. (Sometimes the institutional research function ends here and others interpret the information as they see fit, but not always.) As with science, conjecture about the patterns of data can lead to hypotheses. "Experiments" are sometimes conducted to test the hypotheses. However, that is a point at which science and institutional research diverge, at least in the eyes of the traditional scientist.

Laws and theories have not been identified for a discipline of institutional research. This may be due to the fact that few attempts have been made to look for common principles that underlie inquiries into the same types of phenomena. However, some argue that there are no true laws associated with human social behavior. (See Nagel, 1961, pp. 447-546). A law is "a statement of a relation or sequence of phenomena invariable under the same conditions." "Theory" is defined as "a group of general propositions used as principles of explanation for a class of phenomena." (Random House College Dictionary). Institutional research does not at this point have laws and a body of theory that are specific to a particular discipline. However, institutional research does share some assumptions with the social sciences. They are as follows:

1. Human behavior can to some extent be observed, measured and predicted.
2. There are environmental factors that influence behavior.
3. Some environmental factors that influence behavior can be manipulated.
4. Manipulation of environmental factors, including social factors, can lead to changes in human behavior.

5. Certain environmental and social factors have more influence on human behavior than others.
6. Social factors associated with certain characteristics of individuals may influence the ways in which the individuals behave.
7. Many of an individual's characteristics associated with behavior cannot be changed.

As in the social sciences, many of the relationships identified in institutional research are probabilistic in nature (See Nagel, 1961, pp. 22-23). "Though the premises are logically insufficient to secure the truth of the explicandum, they are said to make the latter 'probable'" (Nagel, 1961, p.22).

One reason laws and theories of institutional research have not been identified is that they have been looked for in the wrong places. Laws and theories are usually in the domain of the empirical. However, the laws and theories of institutional research lie in the realm of the normative. Some of social science is involved in the process of envisioning an ideal, what could be, given the right circumstances. An example is Democratic Theory, the utopian ideal of government that consists of the following three elements: popular sovereignty, majority rule, and equality. Political scientists make observations about how and to what extent governments approximate the utopian ideal of democracy. Institutional researchers often operate under the assumption that there is an ideal condition, predetermined by the mission, goals, and policies of their college or university, or by the immediate needs of the administration. They attempt to find the appropriate information that will contribute to understanding and working toward that ideal. The policies, mission, and goals of the particular institution serve as the body of

theory for that institution (not for a discipline of institutional research). We will call this the theory of the institution. The functions of institutional research are geared to this level. The theory of the institution is concerned with the understanding of the institution's workings and identity.

Strategic planning and management are the processes through which new policies (potential contributions to the theory of the institution) are tested for their ability to contribute to reaching the ideal as stated in the institution's mission and goals. They make up the normative theory of institutional research. We will call this the theory of institutions of higher education. This body of theory is concerned with the processes used to arrive at findings, rather than findings or a generalization of findings.

Laws and bodies of theory have not been identified in institutional research partly because of the types of questions institutional research attempts to answer. Science in general is intended to respond to the question "why?" However, institutional research in its capacity of decision support rarely approaches an issue from an explanatory perspective, but rather responds to the question "which?" When an issue arises concerning a policy decision, the decision makers want to know which choice is the best one when all of the facts available are taken into account. Included within the "which" questions are often smaller questions: "who?", "when?", "where?", "how much?", "did it work?" and "does it matter?" Science, on the other hand, attempts to discover a cohesive set of truths about the nature of reality. In science there is no intent to solve practical problems, only attempts to contribute to knowledge.

A useful analogy may be to imagine that science is an investigation into how

a tool functions or why it works. For example, mathematicians, in their research, may focus on how and why a particular type of statistical operation works. Institutional research, in contrast, assumes that the tool works and applies the tool for its intended purpose to produce something that will be used within a specific real world context. Science creates knowledge, while institutional research goes one step further by using the knowledge created through science to meet practical ends. Institutional research is science applied.

Earlier, we mentioned that institutional research does not have laws and theories in the same sense that we think of science as having laws and theories. This is true, but there are some things that are invariable and act as principles for explaining sets of phenomena in institutional research. Underlying the mission and goals of any institution are two things that do not change in concept, intent toward student success and the maintenance of organizational viability. These figure into the decisions made in an institution of higher education. How student success is defined or measured may depend upon the culture of the particular institution. The strategies used in attempts to maintain the viability of the organization are likely to differ from institution to institution and from one time to another. The constraints on the institution may be location or constituency specific. Nevertheless, all institutions of higher learning share the assumptions that encouraging student success and maintaining organizational viability are inviolable principles.

In the place of theories in institutional research are the assumptions of what is appropriate, important, and beneficial to the unending pursuit of student success and organizational viability. Sometimes, the ways in which these are characterized or envisioned change with what is in vogue in higher education, or with the socially

or politically popular issue of the day. Planning to cope with faculty shortages, providing incentives for increasing cultural diversity, and buffering against budget turbulence are examples of such current issues in institutional research.

Even though these driving principles of institutional research do not at this point make up a cohesive body of knowledge as do laws and theories in science, institutional research is not far removed from science. Any one of the topics of study of institutional research can be broken down into topics of narrow scope suitable for scientific study, and investigated using the laws and theories of one or more of the social sciences for the purpose of adding to understanding of how the world works. Some argue that they should be in order to improve the validity of institutional research.

THE STRUCTURE OF SCIENCE

The logical structure of science, as we know it today, is based on deduction or induction, and experimentation, modelling, and refutation. Each of the building blocks of the form of science was the result of an attempt to correct for flaws in previously used methods of explaining reality.

Deduction was the "science" of Aristotle's day. In deduction, premises are postulated in such a way as to lead to a conclusion that is supported by the premises. The truth of the premises is simply assumed. In institutional research, the assumptions more than the facts are responsible for many conclusions. The truth of the premises that information kept on databases about students. faculty, facilities, and budgets provide meaningful and appropriate answers is assumed. That the mission and goals of the institution are appropriate to achieving student success and ensuring organizational viability is usually assumed. Most important,

it is assumed that applying conventions of science to decision making leads to better decisions than reading tea leaves, or flipping coins.

Deduction moves from generalities to conclusions about a specific. The most famous example of a deductive argument follows:

All men are mortal.

Socrates is a man.

Therefore, Socrates is mortal.

Although deduction is less used in institutional research than induction for arriving at conclusions about the conditions with which the institution must cope, it is not uncommon. An example used in institutional research might look something like the following:

All students must be able to read and write well enough to pass a minimum skills test in order to succeed in school.

John Doe cannot pass the minimum skills reading and writing test.

Therefore, John Doe cannot succeed in school.

Such assumptions may be a part of an assessment procedure used for admissions purposes or for evaluating the effectiveness of a program. The test's validity (of various types) is assumed. The relationship between test performance and success in school is assumed. The truth of the premises is based upon a set of decisions made in an artificial environment instead of being based upon assumed truths about the nature of reality (but philosophical arguments about differences between created reality and perceived reality are beyond the scope of this paper).

Induction, a concept advocated by Francis Bacon for understanding the reality of the world through the facts rather than through preconceived ideas about

the nature of reality, relies on repeated observations of facts. These observations are then used as the basis for predictions. The following is an example of induction: I have observed that for 30 days the sun has set in the west. Therefore, based on these observations, I predict that the sun will set in the west, tomorrow. In institutional research, induction is essential to informing decision making. Trends are frequently used for projecting such things as enrollments, financial needs, market share, attrition, and other factors that colleges and universities must adjust or adjust to for the sake of maintaining viability.

Galileo brought a new perspective to science when he introduced the controlled experiment. Controlled experiments improved upon induction and deduction by narrowing the number of possibilities in establishing causation. With deduction, the relationship was built into the argument as an assumption. With induction it was assumed that a series of like events had the same cause, although causation might never have been addressed in the process of inquiry. The modern conception of science began with the introduction of study of causal relationships.

Although institutional research makes use of experimentation to some degree, it is like the majority of the social sciences in that it is dependent upon using quasi-experimental and non-experimental designs for attempting to understand the relationships between events. More often than not the best that can be achieved in the social sciences is the establishment of a probabilistic relationship between a group and one who shares certain characteristics of that group. (Nagel, 1961).

Institutional research suffers from a variety of methodological problems that go beyond even those of the social sciences. One major difficulty with which institutional research must deal is that the entire population is often the sample upon

which inferences are based. Another is that obtaining sufficient information about the possible influences upon events is often too costly or too time consuming to be of benefit to the institution. The greatest problem is the reactive nature of institutional research. It is often the school's administration that decides which variables would be most useful to understanding the relationships between observed events, possibly resulting in "looking where the light is best," rather than looking where the answers are most likely to lie. The formulation of the question determines the kinds of relationships examined.

Modelling added to science by formalizing a method for representing the relationships between observations. Modelling reduces problems of interpretation of relationships. It provides a "language" upon which all can agree, thereby making it possible for others to converse about relationships between observations in a way that is free from prejudice. Formal mathematical models and statistics and diagrams are the languages used to describe the nature of relationships.

Modelling often provides the most convincing argument for choosing one policy alternative over another in institutional research. Modelling, like scientific method, reduces the information necessary for understanding to a manageable amount. Although the decision makers in the institution may have little understanding of statistics, they may understand a few key concepts, such as significance, correlation, and reduction of error. They may respond to charts and diagrams better than numbers. Once a model is built, it may be used repeatedly for evaluating and for projecting.

It is the use of statistical techniques that leads some who participate in institutional research to believe that they are practicing science. Knowledge of and

skill in the use of sophisticated techniques are erroneously equated with an understanding of how science works. However, statistics and formal mathematical modelling are simply tools. They can be used in the pursuit of scientific knowledge and in the process of arriving at practical solutions, but they are not the same as science. That is not to say that mathematics and statistics cannot be the topic of science. Mathematicians do attempt to explain why and how mathematics and statistics can and do work. Nonetheless, in the structure of science, and in institutional research, such modelling techniques are the products of science applied as tools, and not science.

Refutation is the final major building block in the structure of science as it is practiced today. A hypothesis must be falsifiable or testable in order to make a contribution to knowledge. Popper was the philosopher who brought this concept to the fore. This view became popular as a result of the problems that arose in ruling out alternative explanations for phenomena. Popper realized that it only takes one piece of negative evidence to refute a hypothesis, while no amount of evidence will prove a hypothesis. He argued, "The criterion of the scientific status of a theory is its falsifiability or refutability, or testability" (Casti, 1989, p. 33).

Testability is central to the function of institutional research. However, testability has a slightly different meaning for institutional research. The "hypotheses and theories" tested are the ones associated with the particular institution. Institutional research exists to inform decision making. If there were no alternatives, there would be no reason to make a decision. If there were no way to demonstrate the superiority of one alternative over another, flipping a coin would be adequate decision support.

Institutional research and science are not one and the same. That is not necessarily to be perceived as a disadvantage for either one. Pure or basic science is ill suited to the needs for which institutional research was created. The goal of institutional research is to reduce uncertainty in practical decision making. The rigors of science, along with its goal of contributing to knowledge, are much too limited for this purpose. Institutional research deals with more than a single question at a time; instead it deals with an "ecology" (Cleveland, 1988, p. 584) in which a balance must be struck among conflicting factors and factions. Finances, quality of instruction, market share, cultural diversity, student needs, and the influences on and of other social and environmental entities are often aspects of an issue that must be addressed in order to inform a single decision.

Institutional research is more an art than a science. It requires understanding of models, techniques, theories and laws from other disciplines to inform decision making. However, sorting out what is important to the institution's viability requires more. Insights into the institutions character, culture, history and environment are necessary to understanding the state of the institution's ecology and the nature of the question to be answered. This is especially true when the ambiguity surrounding the question is great. These are things that science generally ignores due to the need to be sufficiently rigorous. Science is too narrow to support organizational decision making.

KUHN'S PERSPECTIVE: THE SOCIAL STRUCTURE OF SCIENCE

The concept of the paradigm (Kuhn, 1962, 1977) provides yet another construct for exploring the links between institutional research and science. A paradigm is a metaphor for understanding the world. Some might even equate it

with Weltanschauung (world view). A paradigm is a set of shared beliefs about the nature of reality. That set of beliefs determines what is meaningful and important, how the important and meaningful things can be examined, and where answers can be found. Kuhn refers to those who share such a set of beliefs and share in the practice of a scientific specialty a "scientific community" (1962, p. 16).

Kuhn suggests that a scientific community shares a "characteristic set of beliefs and preconceptions" (1962, p. 17). Institutional research has something near to a "scientific community" as defined by Kuhn. The goals of encouraging student success and maintaining institutional viability are shared by those who fulfill the function of institutional research. Many of the techniques used in institutional research are shared. The same kinds of problems are the focus of attention of those associated with institutional research. And even though findings of studies may not be generalizable to other institutions, the processes used to arrive at the results may be generalized in that they become the accepted methods of analyzing certain information to inform decisions.

Kuhn also states that members of a scientific community share common educational experience and are socialized to share commitments to certain values. Even though institutional researchers come from diverse educational backgrounds, they usually share some training in the use of statistics, in one or more of the social sciences, and in computer usage. They are socialized to the specialization via professional organizations, conferences, and professional journals.

Institutional research is in a pre-paradigm stage; no body of scientific theory controls the kinds of questions that can be asked nor the kinds of answers sought. This is nothing for institutional researchers to be embarrassed about. According to

Kuhn, "it remains an open question what parts of social science have yet acquired... [universally accepted] paradigms at all" (Kuhn, 1962, p. 15). Yet institutional research does have principles that provide guidance in what is appropriate to study. The principles involve perpetuation of higher education in particular contexts. Even though institutional researchers share no single paradigm, institutional research has undergone changes on the order of paradigm shifts.

Each time a new issue emerges as one of the goals of the institution, institutional research must adjust to incorporate the concept into investigation of each question posed. Diversity is a prime example. Over time, we have seen a change in the rhetoric used to describe attempts to reduce racial discrimination and increase racial harmony. First, the term was "desegregation." Later it was called "integration." Now it is called diversity. Each change has represented a different focus for institutional researchers. Each change has resulted in a different treatment of information. Since diversity has become a major goal of institutions, all choices must be weighed against the possibility of jeopardizing progress toward that goal.

CONCLUSION

Because institutional research is dependent upon the politics of higher education and upon the social goals of government and communities, identification of what is relevant will change. This dynamic nature of institutional research demands that the observer shift his or her vision in pattern identification frequently. For that reason, institutional researchers are constrained in their attempts to develop a cohesive body of knowledge. If institutional research were not so dependent upon the perceptions of those within a particular institutional context, it might be possible for a discipline to emerge.

However, institutional research is a support function for institutions of higher education. An issue is important to a particular institution only when it is recognized as an issue. For the most part, others set the agenda for institutional research. Sometimes it is the government; sometimes it is the school's administration. There is little incentive for this to change.

Institutional research has many links with science. It makes use of scientific method. It shares elements of science's logical structure. And it is practiced by a particular community that shares some beliefs about what is important to study, and how to study what is important. Nonetheless, institutional research is different from science in meaningful ways, the most important of which is the difference in purpose. Institutional research uses scientific conventions as tools to achieve its purpose of answering "which" questions. That is not to say that institutional researchers never participate in science; that is not the point. The "theory" of the single institution determines the nature of a study in institutional research. The theory of institutions of higher education, that each institution has a mission, goals, strategies, and a set of assumptions about how questions should be approached (whether or not these have been made explicit), is what creates a community of institutional researchers.

This discussion has only begun the process of identifying ideal types for institutional research. Refinements of the structure discussed herein, the identification of assumptions, and the recognition of unifying principles in research will contribute to greater understanding of institutional research as a unique disciplined pursuit and assist in the strengthening of the institutional research community.

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