

A1 IN SEARCH OF A PARADIGM FOR INFORMATION SYSTEMS RESEARCH

Robert D. Galliers
Western Australian Institute of Technology
Australia

Abstract

This paper attempts to identify some of the shortcomings of traditional (e.g., empirical, scientific) research approaches in the context of research related to the field of Information Systems (IS). It goes on to identify a number of the alternative approaches which are currently being attempted in an effort to avoid some of the more major pitfalls encountered in undertaking IS research in traditional mode.

Much of the paper is based on discussions which took place at the IFIP Working Group 8.2 Colloquium "Information Systems Research: A Doubtful Science?" However, in reviewing this discussion, the author has also attempted to develop a paradigm to aid in understanding the approaches which might appropriately be used in attempting IS research.

It is hoped that this paradigm will prove useful in future attempts at synthesizing the results of different IS studies dealing with similar subject matter. Currently, such attempts at synthesis tend to founder on the rocks of—as Ein-Dor and Segev put it—"lack of a common theoretical framework to provide consistent underlying assumptions." They go on to point out that "It is the lack of such a framework that prevents the orderly and cumulative acquisition of knowledge in the area" (Ein-Dor and Segev 1981, p. 227).

At a time when technological advances are occurring in the information field at such a rapid rate, it is essential that we improve our knowledge regarding the appropriate uses to which this technology can be put and its impact in organizations and on society as a whole. Lack of such understanding is a major limiting factor in the effective use of information technology for organizational and societal decision making. There is therefore an urgent need to develop our understanding of appropriate approaches to research in the IS field in a variety of different circumstances and with a variety of different objectives in mind. It is hoped that this paper contributes to this understanding.

The Failure of the Scientific Approach in IS Research

Many authors have written critiques concerning the use of the scientific method in IS research (Antill 1985; Mingers 1980; Nissen 1985; Wood-Harper 1985). However, before attempting a review of what has been said on the matter, it is perhaps appropriate to identify what constitute the major characteristics of the method of science.

Checkland (1982, p. 13) defines these major characteristics as repeatability, reductionism and refutability. Others, for example Klein and Lyytinen (1985), talk of the strengths of the scientific method as including objectivity, rigor and respect for the facts.

Unfortunately, these key characteristics and strengths turn out to be weaknesses, or are at least problematic, when one considers what is appropriate for social science, and more particularly IS, research. Let us take each aspect in turn and identify what the problems are.

There is nothing new in pointing out how difficult it is to conduct repeatable experiments in the context of social science. After all, Heraclitus some two and a half thousand years ago, in identifying the changing underlying character of nature, pointed out that we cannot step into the same river twice! So it is with IS research, "the very act of installing an information system [changes] the situation into which it is installed. Therefore no particular 'experiment' can be repeated" (Antill 1985).

The arguments against the use of reductionist thinking in any kind of organizational research have been identified in detail by Checkland (1981, pp. 59-92). The method by which science deals with complexity is based on Descartes' second rule, namely to divide problems into manageable parts. This we know as *reductionism*. The assumption is "that this division will not distort the phenomenon being studied...that the components of the whole are the same when examined singly as when they are playing their part in the whole" (Checkland 1981, p. 59). The evidence is that this assumption is reasonable in the physical sciences, less so in the social sciences.

In an attempt to avoid the pitfalls associated with reductionist analysis in the field of social sciences, the systems movement has arisen. This movement "which unites systems thinkers in many different fields" uses ideas which are

an attempt, within the broad sweep of science, to retain much of that tradition but to supplement it by tackling the problem of irreducible

complexity via a form of thinking based on wholes and their properties which compliment scientific reductionism...systems thinking [being] founded upon two pairs of ideas, those of *emergence and hierarchy*, and *communication and control*. (Checkland 1981, pp. 74-75)

The third characteristic of the scientific method—refutability—is similarly problematic in the context of the social sciences. As Checkland puts it, the problem of making predictions of social happenings

must be [partly] a matter of shared complexity, the fact that what happens is always a mix of intended and unintended effects. But additionally there are other problems. For one thing predictions on the outcome of observed happenings in social systems may change the outcome. *Physical systems cannot react to predictions made about them; social systems can.* (Checkland 1981, p. 70; emphasis added).

Popper, in the Preface of his book *Poverty of Historicism* (1957), takes the argument further by reasoning that laws similar to those common in the physical sciences are impossible to establish in the social sciences. Checkland (1981, p. 70) summarizes the argument as follows:

the happenings in social systems are strongly influenced by the growth of human knowledge; *the future* growth of knowledge is in principle unpredictable since we cannot know the not-yet-known; therefore the future of social systems cannot be predictable. “This means that we must reject the possibility of a *theoretical history*, that is to say, of a historical social science that would correspond to [e.g.] *theoretical physics*.”

So, one of the key planks upon which the scientific method is based—refutability—is a vexed question in any form of social scientific research. This is true not only from the point of view of establishing the very laws which we must then attempt to refute, but also—even if we were able to establish them—the problems associated with their application in real life (i.e., in predicting future outcomes) since these are, as we have seen, so great as to make the process impossible.

So much for the characteristics of the scientific method in the context of research in the social sciences. What of the strengths of the scientific method in our context?

Two of the three strengths identified by Klein and Lyytinen (1985)—objectivity and respect for the facts—turn out to be practically impossible to achieve when undertaking IS research. Our perceptions of actions or re-actions associated with the use of IS will be colored by what can alternatively be called our *bounded rationality* (Simon 1957), our *appreciative system* (Vickers 1970), or our *cognitive filter* (Land 1984). Our vision is, to some extent at least, blinkered and we are always likely to place a specific interpretation on events according to our *Weltanschauungen* (Checkland 1981, pp. 215-221): our taken-for-granted, almost subconscious, images of the world which enable us to give meaning to observed events.

In IS research, we would obviously make every attempt at objectivity but we should always bear in mind our limited vision. When it comes to respect for the facts, the appropriate question to ask is “whose facts?” since many interpretations are always likely and indeed, are perfectly valid.

Rigorousness in research is always something for which one should strive. But rigorousness in the context of IS research as opposed to research in the physical sciences may well mean quite different things. While we seek to use relevant facts at the expense of “armchair speculation,” while we seek to ensure that “all trained observers at all times should be able to reach the same conclusions” (Klein and Lyytinen 1985, p. 5), there is, as we have seen, every likelihood that, no matter how rigorous our research is, this desired result will not always be achievable.

There is a further, equally significant point to raise regarding rigorousness in IS research, and that is that rigor “can frequently be only achieved at the expense of *relevance* and that the question ‘relevant to whom?’ is not accessible to the rigorous methods espoused” (Klein and Lyytinen 1985, p. 6, emphasis added).

Checkland (1981, pp. 68-71) summarizes the distinguishing features of social as compared to scientific enquiry as:

- the possibility of many different interpretations of social phenomena,
- the impact of the social scientist on the social system being studied,
- the problems associated with forecasting future events concerned with human societal activity (e.g., there will always be a mixture of intended and unintended effects and there will always be the danger of self-fulfilling prophecies or the opposite).

In the light of the above, the prognosis for valid research in IS does not look particularly optimistic. In the context of the view expressed by Bleicher (1982, p. 14), for example, this is understating the case by some considerable degree, viz:

The empirical-analytical method is the only valid approach to improve human knowledge. What can't be investigated using this approach, can't be investigated at all scientifically. Such research must be banned from the domain of science as “unresearchable.”

Notwithstanding such views, let us turn to the approaches which are being attempted in IS research so that an assessment can be made of the current “state of the art.”

Current Approaches to IS Research

Ein-Dor and Segev (1981, pp. 227-288), after Van Horn (1973), identify four principal modes of research which are used in the study of MIS, namely:

- laboratory experiments,
- field experiments,
- surveys, and
- case studies.

This list is confirmed by Vitalari (1985), who links these approaches with research objectives, as follows:

1. Research to improve the effectiveness of information systems in practice (utilizing either the laboratory or field experiment approaches).
2. Research to study IS failures or implementation efforts (utilizing the survey or case study methods).
3. Research to study the impact of information technology (IT) and IS on organizations (again utilizing the survey or case study methods).
4. Research into the role and effects of IT and IS on society (once again, such studies might utilize the survey or case study methods).

However, in view of the fact that the latter is concerned with “the emergence of new social forms and behaviors, and the development of the so-called information society or information age” (Vitalari 1985), such studies also, and perhaps more appropriately, are undertaken in the mode of

- futures research.

In this kind of research, different scenarios, or futures, are postulated and the different impacts of IT and IS are identified given these different situations. (See, for example, the work carried out on behalf of the Commission of the European Economic Communities [1982] under the auspices of the FAST¹ program and particularly that of Barnett et al. [1981]). This kind of research has also been successfully attempted *within* organizations, i.e., of research type 3 using the Vitalari classification see, for example, the work of Nilles (1984) and Nilles, Mohrman and El Sawy (1983).

The emphasis given by Van Horn is on empirical research and while his work was published in 1973, a great proportion of IS research carried out today still retains this flavor, despite all that has been written concerning the limited applicability of such approaches in this context. For example, work undertaken by Hamilton, Ives and Davis (1980) indicates that almost half of the doctoral dissertations in the IS field submitted between the years 1973 and 1979 utilized traditional, empirical, approaches.

To this list we might therefore usefully add a number of approaches which have been attempted of late as a means of avoiding some of the more obvious pitfalls of the traditional approaches which have already been discussed. The following list is taken from the approaches presented at the IS Research Colloquium. These new approaches might be labeled:

- phenomenological studies/hermeneutics (Boland 1985; Brittain White 1985; Kendall and Kendall 1985) and
- longitudinal studies (Pettigrew 1985; Vitalari 1985).

One further approach should also be mentioned, namely

- action research (Checkland 1981; Clark 1972; Foster 1972; Wood-Harper 1985)

even though it might be viewed as a subset of the case study and field experiment categories already listed. The category is included in view of the underlying philosophy of action research which sets it apart from the more traditional modes of investigation.² For example, the roles of subject and researcher can easily be reversed at times during

¹FAST: Forecasting and Assessment in the field of Science and Technology.

²For further discussion on the subject of action research as distinct from the more traditional forms of applied research, see Clark (1972, pp. 22-25) and Checkland (1981, pp. 151-154).

action studies (Clark 1972) and the fact that the researcher will affect the situation (s)he is researching is made overt by the researcher actively associating him/herself with the practical goals of the research in addition to any theoretical objectives which may have been set (Foster 1972).

Papers in support of the researcher actively associating him/herself with particular practical outcomes of the research given at the Colloquium tended to come from the Scandinavian countries and included:

- “Trade Union-Oriented Research for Democratization of Planning in Working Life—Problems and Potentials” by Åke Sandberg (1985), and
- “Critical Social Theory (CST) as a Basis for the Theory of Information Systems” by Kalle J. Lyytinen and Heinz K. Klein (1985).

While the major impetus for the use of IS research for emancipatory purposes appears to have come from Scandinavia, I have not gone as far as to include the “Scandinavian Model” (Bjørn-Andersen 1985) as a separate category to action research in view of the fact that a large proportion of action research studies undertaken outside Scandinavia have had as their underlying purpose, emancipation.³

The list cannot claim to be comprehensive but it is hopefully representative of the range of approaches being used currently.

An attempt has been made, in Table 2, to summarize the key features, advantages and disadvantages, of these approaches. However, in view of the novelty of some of the approaches presented at the Colloquium, the essential features of:

- phenomenological studies/hermeneutics, and
- longitudinal studies are first described.

Phenomenological Studies

Three examples of this kind of interpretive approach to IS research which were presented at the Colloquium are:

- “Phenomenology: A Preferred Approach to Research on Information Systems” by Richard J. Boland Jr. (1985),
- “Perceptions and Deceptions: Issues for Information Systems Research” by Kathy Brittain White (1985), and
- “Development, Application, and Enrichment of STROBE: Refinement of an Observational Tool for the Information Analyst” by Kenneth E. Kendall and Julie E. Kendall (1985).

In introducing the phenomenological approach, Boland (1985) indicates that it is “practiced in a number of different ways today, but springs from the work of Edmund Husserl.” Husserl (1978) “was against naively positive approaches to science, especially the uncritical use of positive, natural science methods in psychology [which was] heavily dependent on unchallenged presuppositions.” Further, in explaining a major distinction between the method of science and phenomenology, Boland explains that the former “is

³See, for example, Galliers et al. (1981) and the debate concerning the underlying philosophy of soft systems methodology (Ackoff 1982; Checkland 1982; Jackson 1982; Mingers 1980, 1984).

concerned with finding out *how* things work [while] phenomenology, in contrast, is concerned with finding out *what* things are.”

Phenomenology is, then, an approach which sets out to *describe* the situation being studied, with a view to producing “truly objective knowledge [which, while] it cannot claim to have proof of its findings [it can place] a reliance on its method and the hope that others will ‘see’ its descriptions as true and accurate” (Boland 1985). Another key aspect of the approach is its self reflective nature:

The process of recognizing prejudice and bracketing assumptions is applied to the method of study concurrently with its application to the object of study. The phenomenologist always includes himself or herself and the method being used as part of the phenomenon being studied. The phenomenologist sees positive science and its claim of freedom from prejudice and presumption as a conceit. (Boland 1985)

Boland goes on to draw on the work of Hans-Georg Gadamer (1981) in introducing the point that “phenomenology is an act of interpretation” when emphasizing the importance of hermeneutics in IS research: an argument very much in line with the philosophy underlying Checkland’s soft systems methodology (1981, pp.273-277), viz:

The use, design and study of information systems is best understood as a hermeneutic process. The information system is a text that must be read and interpreted by people other than its author. This is a hermeneutic problem. The information system designer reads the organization and its intended users as a text in order to make an interpretation that will provide the basis for a system design. This is also a hermeneutic problem. (Boland 1985)

The self-reflective character of IS research is a theme taken up by Brittain White (1985). She stresses the point that researchers are subjective people who will undertake their research from a particular standpoint or bias. In order to carry out reasonably valid research, this standpoint must be made overt. One’s analysis must therefore contain an element of introspectivity.

The approach espoused by Kendall and Kendall (1985) emphasizes the importance of the physical environment in which information users work when undertaking information analysis, and postulates a structured means by which this environment can be described, based on the *mise-en-scene* approach to film criticism. They name their approach STROBE, which stands for **S**tructured **O**bservation of the decision making **E**nvironment.

Concerned that mere observation of the environment may miss important elements, they recommend the use of photography so that repeated analysis can take place easily and unobtrusively.

The kind of analysis that can be carried out on the photographs is illustrated in Table 1, which was developed using a Likert-type scale relating to “seven decision-maker characteristics observable through physical elements in the decision makers’ organizational environments” (Kendall and Kendall 1985).

Table 1. Example of STROBE Scales for Observing the Physical Environment (Kendall and Kendall 1985)

Office lighting, walls, paintings and graphics are warm-toned, creating an informal arena for information exchange

1	2	3	4	5
fluorescent lights, cool-colored walls, no decorations				incandescent lights, warm-colored walls, warm graphics

Office contains various forms of information brought in from outside the organization, including trade journals, association newsletters, and business newspapers

1	2	3	4	5
no outside sources of information				four or more journals or newspapers

Aids for processing of information are present in the office and are easily accessible

1	2	3	4	5
no calculators or CRTs visible				calculators or CRT accessible without leaving chair

Office houses many pieces of equipment used for storing information

1	2	3	4	5
no storage cabinets in office				four or more file cabinets or shelves

Desk is placed to maximize territory for administrator and limit visitor space

1	2	3	4	5
desk placed against wall				desk used as barrier with little space for visitor

Wears authoritative business suits rather than casual or sporty clothing

1	2	3	4	5
wears casual or sporty clothing				wears conservative business suits

Administrator's office is easily accessible

1	2	3	4	5
office located on separate floor from subordinates				office within 50 feet of subordinates

Longitudinal Studies

Calls at the Colloquium for a longitudinal approach to IS research came from two different perspectives: that of Pettigrew (1985) and of Vitalari (1985).

Pettigrew expands on the concept of *contextualism* as an appropriate approach to research in organizations. He describes contextualism as being “concerned with the event in its setting.” He goes on to say that “the truth theory has to be qualitative confirmation since the context will change and knowledge will need to change also, and the root metaphor is the historic event.” In a sense then, the Pettigrew approach is similar in underlying philosophy to that of the phenomenologists: the major distinction being that while the latter attempt to make explicit the prejudices of the researcher, he points out the dangers associated with the “prejudice” of the moment in time that the research happens to be undertaken.

The implication is that there is a need to view the relationship between organizational structure and process in the context of historical change:

Time itself sets a frame of reference for what changes are seen and how those changes are explained. The more we look at present day events the easier it is to identify change, the longer we stay with an emergent process and the further back we go to disentangle its origins, the more likely we are to identify continuities....Without longitudinal data it is impossible to identify the processual dynamics of changing, the relationship between forces of continuity and change, and therefore the inextricable link between structure and process. (Pettigrew 1985)

The basic approach to contextualist research is described as:

1. Description of the process(es).
2. Exposure of variability or constancy in 1.
3. Commencement of the analysis of 1 by using existing, or developing novel, theories of process.
4. Identification of the contextual levels of analysis, e.g., an intra-organizational analysis of process versus an environmental analysis.
5. Description and analysis of variability across the contexts through which 1 occur(s), and of any trends in the contexts over time.
6. Consideration of the alternative criteria by which to judge the outcome of 1 (Pettigrew 1985).

In summary, the approach provides a means of answering “what are the relationships, if any, between variability in context, variability in process, and variability in outcome?” The approach is concerned with not only “*solving*” problems but “*finding* problems through detailed immersion in context” (emphasis added). Both the manager and the contextualist “are interested not just in accurate description of what is happening but the mechanisms which provide opportunities and constraints for making things happen” (Pettigrew 1985).

Vitalari (1985) echoes these sentiments by arguing that the study of change is central to IS research and that the limitations associated with traditional modes of enquiry can be avoided through the application of longitudinal designs:

Table 2. Approaches to IS Research: A Comparison⁴

IS Research Approaches	Major Purposes						Key Features	Strengths	Weaknesses
	improving efficiency	improving effectiveness	IS failures	IS development approaches	individuals	organizations			
Laboratory Experiments	✓	✓			✓		Identification of the precise relationship between variables via a designed laboratory situation using quantitative analytical techniques in the hope of making generalizable statements applicable to real-life situations.	The isolation and control of a small number of variables which may then be studied intensively.	The limited extent to which identified relationships exist in the real world due to over-simplification of the experimental situation and the isolation of such situations from most of the variables which are found in the real-world.
Field Experiments		✓			✓	✓	Extension of the laboratory approach to real organizations.	The isolation and control of variables for study in real-life situations.	Finding organizations prepared to be experimented on. Achieving sufficient control to enable the replication of situations with only the study variables being altered.

⁴Based in part on Ein-Dor and Segev (1981, pp. 228) and Vitalari (1985).

Surveys			✓	✓	✓	✓	✓	Obtaining “snapshots” of practices, situations, views at a particular point in time via questionnaires and/or interviews from which inferences may be made via quantitative techniques regarding the relationships of variables in the past, present and/or the future.	Greater number of variables may be studied than in the above two methods. Description of real-world situations.	Little insight is usually obtained regarding the causes or the processes behind the phenomena being studied. Possible bias in the respondents (especially those responding to questionnaires since they will be self-selecting), in the researcher, and in the moment in time that the research is undertaken.
Case Studies	✓	✓	✓	✓		✓		An attempt at describing the relationships which exist in reality, usually within single organizations.	Capturing reality in even greater detail than is possible using the survey approach and dealing with an even larger number of variables than in the above.	Restriction to a single event/ organization. Difficulty in acquiring similar data from a statistically meaningful number of variables and particular circumstances pertaining to individual situations. The different interpretations which can be placed on reality by individual researchers.
Futures Research		✓			✓	✓	✓	A variety of approaches can be attempted, e.g., scenario building using <ul style="list-style-type: none"> – the delphi method – identification of strengths, weaknesses, opportunities and threats – identification of facts, “heavy trends” and issues. 	In changing economic and political environments, existing relationships may well not hold true in the future. The forward looking nature of futures research avoids such problems and attempts to deal with the rapid changes taking place in IT and their impacts on individuals, organizations and society in general.	The complexity of the variables under study and the lack of real knowledge concerning changing relationships. Scenarios built using a variety of methods are not true pictures of the future but are designed merely to enable organizations to understand what may be required to be done given different futures.

Phenomenological Studies/ Hermeneutics	✓	✓	✓	✓	✓	✓	✓	An attempt at describing the relationships which exist in reality which also emphasizes the role of the researcher and his/her interpretation of the topic of study.	Recognition of the fact that the researcher will interpret what is being studied in a particular way. A means of describing the interrelationship of many factors found in real-life.	Despite making the prejudice of the researcher known, this could still cloud the interpretation of reality and thus make the research conclusions subjective. In addition, the relationships observed may only exist for that particular point in time when the research is undertaken.
Longitudinal Studies			✓	✓	✓	✓	✓	Case studies undertaken over a period of time enabling the identification of changing relationships and their causes.	This approach by-passes the problems associated with the identification of relationships at a particular point in time.	Difficulties associated with undertaking research in a single organization or the same organizations over a period of time. Difficulties associated with the identification of cause and effect when dealing with complex and changing inter-relationships.
Action Research	✓	✓	✓	✓	✓	✓	✓	Applied research where there is an attempt to obtain practical results of value to groups with whom the researcher has allied him/herself while at the same time adding to the body of theoretical knowledge.	Practical as well as theoretical research aimed for the most part at emancipatory results.	This approach places a great deal of responsibility on the researcher who must be aware that in certain circumstances (s)he is aligning him/herself with a particular grouping whose objectives may well be at variance with other groupings. The ethics of the research must therefore be an issue of paramount importance; i.e., a potential weakness in the wrong hands.

- ...a longitudinal design that includes open-ended questions and measures to assess attitudes and values permits the researcher to observe and analyze the way in which values change over time....
- ...longitudinal design encourages the use of multiple measures [which] allow the researcher to look at the same phenomena from several different perspectives.
- ...longitudinal design is one of the only research methods available, other than case studies and retrospective reconstructions, for observing the process of human volition and choice in a social context. However, such activity very seldom becomes evident in a short time frame.

In summary, therefore, I have attempted to expand upon the taxonomy of IS research approaches posited by Van Horn ((1973) to illustrate that new approaches are being attempted with a view to bypassing the problems associated with traditional methods in the IS context. The list, which is repeated below, cannot claim to be comprehensive but does appear to represent the major approaches being attempted currently:

- laboratory experiments
- field experiments
- surveys
- case studies
- futures research
- phenomenological studies/humeneutics
- longitudinal studies
- action research

IS Research Methodologies: An Extended Taxonomy

One of the major conclusions to come out of discussions at the IS Research Colloquium is that it is important for the IS research community to clearly label the various IS research approaches, their strengths and weaknesses and the purposes to which each approach might appropriately be put. This I have attempted in Table 2.

This extended taxonomy attempts to take into account the novel approaches that are presently being attempted as well as the older, empirical approaches still used in IS research. It aims to provide a useful framework so that consideration can be given to the appropriate approaches IS researchers might use in undertaking studies of particular kinds and with particular objectives in mind. The framework will doubtless require further revision and extension in the light of current and future practice, but it is hoped that it will turn out to be a useful starting point for further considerations of this difficult problem.

Contributors to the IS Research Colloquium were agreed that further work is required in this area and a task group on IS research methods within IFIP Working Group 8.2 is in the process of being set up with Hans-Erik Nissen of the University of Lund as its coordinator. A state-of-the-art report is to be published in 1986. In the meantime, this paper

may be of assistance in providing the IS researcher with a useful paradigm—a framework with which to select an appropriate methodology.

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