INFORMATION SYSTEMS RESEARCH:
Contemporary Approaches and Emergent Traditions
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CHOOSING APPROPRIATE INFORMATION SYSTEMS RESEARCH APPROACHES: A REVISED TAXONOMY

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Abstract

This paper attempts to review the range of approaches that have been advocated as being suitable for research in the field of Information Systems. *Inter alia*, it assesses their strengths and weaknesses, divides the approaches into two categories: 'empirical' and 'interpretive', and summarises the arguments for rethinking the view that it is only the empirical approaches that produce usable and useful results. In addition, the approaches are placed in the context of the process of building and extending information systems theory.

As a result of this analysis, a revised taxonomy of information systems research methods is developed. This taxonomy attempts to identify the situations in which individual approaches appear to be best suited in relation to (i) the general topic area (ie., the *object*) of the proposed research and (ii) the process of theory development and extension in the specific topic area being researched.

The paper concludes with some practical guidelines in the use of this revised taxonomy when choosing an appropriate research methodology for a particular information systems research project.

1. INTRODUCTION

A range of research approaches has been recommended for use in the general field of Information Systems. A particular approach is likely to have its adherents who, all too frequently, argue (often, most cogently) for its *universal* applicability. "All too frequently" because, as in most aspects of Information Systems, an approach with universal applicability is highly unlikely.

Examples of this behaviour can be found in the *Proceedings* of the IFIP WG 8.2 Colloquium "Information Systems Research - a doubtful science?" held in September 1984 (Mumford, *et al.*, 1985), which was the forerunner to ISRA-90. Perhaps it is enlightening to note the title - "Information Systems

Research Methods" - given to the published version of the Proceedings, as compared to the title of the Colloquium itself.

In their introduction, the editors note the change and remark that the reason for it "will have to remain a mystery" (*ibid.*, p.3). My view has been that the change was brought about - in part at least - by the very nature of many of the papers presented. The Colloquium was held to "enable a concern about research methods in information systems to be aired" and to "ask whether the scientific research methodology is the only relevant methodology for information systems research or indeed whether it is an appropriate one at all" (*ibid.*, p.3). Many of the presenters at the Colloquium interpreted these objectives as an invitation to argue for their *particular* approach to information systems research, rather than as an opportunity to review the *range* of approaches available, with each being more or less appropriate in different circumstances.

Additional evidence, from the other side of the Atlantic, which supports the view that the research approach adopted is likely to be affected more by the *location* of the research than by the *object* of that research, comes from the *Proceedings* of a similar Colloquium, held at the Harvard Business School at about the same time (McFarlan, 1984), and from a paper by Vogel and Wetherbe (1984). Both sources analyse, *inter alia*, the research approaches adopted by a number of Information Systems faculties in the United States of America. While it would be an exaggeration to contend that each faculty utilises a single approach only, it is possible to discern a particular 'house style' in many instances. Given acceptance of the proposition that no one single approach is universally applicable, this fact gives some cause for concern. Given, too, the unfortunate preponderence of Information Systems discourse which does not adequately deal with the question of *choice*[1] of research approach (both in terms of what is an appropriate choice, and of the likely effects of a particular choice on the results), one's level of concern becomes the greater.

In the light of the above, a means of identifying which approaches appear most suitable in particular circumstances would appear to be a useful contribution to a debate on Information Systems Research Methods. It is with this in mind that this paper was written. It sets out to use the 1984 Colloquium as a base for:

(i) assessing the strengths and weaknesses of the various research approaches that have been, and are being, used in the Information Systems field

1. Exceptions to this general rule are provided by Keys (1988) in respect of alternative problem solving methodologies, and Benbasat (1984) in respect of alternative research approaches in the field of Management Support Systems.

(ii) developing a revised taxonomy of research methods which takes into account their relative strengths and weaknesses in the context of the particular aspect of Information Systems under study, and of the process towards theory development and extension

(iii) using the taxonomy to assist the would-be researcher in choosing an *appropriate* information systems research approach.

2. APPROACHES TO INFORMATION SYSTEMS RESEARCH

A number of taxonomies of information systems research approaches have been postulated over the years. Table 1 attempts to summarise the major approaches identified. In addition, several taxonomies of organisation theory suggest suitable approaches to information systems research (*eg.*, Morgan, 1980; Benson, 1983).

In identifying alternative research styles, I have used the word *approaches* as opposed to *methods*. This is because I wish to differentiate between the two terms. As Weick (1984, p.121) argues, "*Methods* are simply ways to systematize observation" (my italics). Different *approaches*, as the term is used in this paper, are a way of going about one's research. They may embody a particular style and may employ different *methods* or techniques. *Approaches*, as the term is used here, is therefore a more generic concept than *methods*.

Weick (1984) provides a list of alternative ways of observing events when discussing alternative *methods*, to which I have added references to various *approaches* (the latter are themselves described in more detail in section 4), *viz.*:

-*sustained,cf.*, longitudinal research, as advocated by, *eg.*,Pettigrew (1983) and Vitalari (1985)
-*explicit, ie.*, "procedures [that] are ... open and contestable ... and capable of reconstruction" (*cf.*, experimental research
-*methodical,ie.*, methods that adhere "to an orderly sequence of data collection" (*cf.*, survey research)
-*observing,ie.*, "examining steadily and in detail the stream of events toward which attention is directed", *eg.*, Barton & Lazarsfeld (1969) (*cf.*, case study research)
-*paraphrasing*, which might be likened to labelling events, *cf.*, phenomenological research, as advocaged by, *eg.*, Husserl (1936) and Boland (1985)
-*social situations, ie.*, observations of interactions "among a place ..., actors ..., and activities", as opposed to solitary research
-*naturally occuring contexts, ie.*, observations of uncontrived environments that allow "one to ask how and why these things are going on."
(Weick, 1985, pp.121-124).

Researchers / Approaches	Van Horn (1973)[2]	Hamilton & Ives (1982)	Vogel & Wetherbe (1984)	Galliers (1985)/ Galliers & Land (1987)	Farhoomand (1987)
Laboratory Experiments	*	*	*	*	*
Field Experiments	*	*	*	*	*
Surveys	*	*	*	*	*
Case Studies	*	*	*	*	*
Theorem Proof			*	*	
Subjective/ Argumentative[3]		*	*	*	*
Empirical[4]			*		
Engineering			*		
Reviews		*			
Action Research				*	
Longitudinal				*	
Descriptive/ Interpretive				*	
Forecasting/ Futures Research				*	
Simulation[5]				*	

Table 1: Approaches to Information Systems Research: A Summary

2. This list is confirmed by Ein-Dor & Segev (1981, pp.227-228).

3. The "subjective/argumentative" category used by Vogel & Wetherbe (1984) may reasonably be equated with the "conceptual" category of Hamilton & Ives (1982) and the "non empirical" category used by Farhoomand (1987).

4. The "empirical" category used by Vogel & Wetherbe (1984) is seen as a more generic term by, *eg.*, Blake & Ives (1982) and Galliers & Land (1987). In the latter cases, the term incorporates the "field" and "laboratory experiments" categories, together with "case studies" and "surveys".

5. Includes "game/role playing".

When reviewing Table 1, it is reasonable to divide the approaches into two categories, which can be labelled *scientific* (empirical) and *interpretivist*. Scientific approaches may be defined as those that have arisen from the scientific tradition - characterised by repeatability, reductionism and refutability (*cf.*, Checkland 1981, p.13) - and which assume that observations of the phenomena under investigation can be made objectively and rigorously (*cf.*, Klein & Lyytinen, 1985). Interpretivist approaches argue that the scientific ethos is misplaced in social scientific enquiry because of, *inter alia*:

> "-the possibility of many different interpretations of social phenonema
> -the impact of the social scientist on the social system being studied
> -the problems associated with forecasting future events concerned with human ... activity [given the fact that] there will always be a mixture of intended and unintended effects and ... the danger of self-fulfilling prophecies or the opposite." (Galliers, 1985, p.284. After Checkland, 1981, pp.68-71).

The argument of those who espouse the scientific approach may be summarised (somewhat tautologically) as follows:

> "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'." (Bleicher, 1982, p.14).

This leads a number of information systems researchers into the following "illogic", according to Weick (1984, p.129):

> "1. Every real phenomenon can be measured
> 2. If it can't be measured, it's not real
> 3. If it can be measured, it is real".

There are others who argue for eclectic approaches, given that Information Systems is a "fragmented field or, to put it in other words, an essentially pluralistic scientific field". In view of this, Banville and Landry (1989, p.48) argue that the field of Information Systems can best "be understood and analyzed with the help of plurastic models".

Returning to Table 1, it is possible to divide the approaches into the two camps as follows:

Scientific	Interpretivist
Laboratory Experiments	Subjective/Argumentative Reviews
Field Experiments	Action Research
Surveys	Descriptive/Interpretive
Case Studies	
Theorem Proof	
Forecasting	Futures Research
Simulation	Role/Game Playing

Table 2: Information Systems Research Approaches in the Context of the Scientific and Interpretivist Philosophies.

As can be seen, I have split the forecasting-futures research approach and the simulation-role/game playing approach between the two camps according to their underlying ethos. Similarly, case studies have been included in the scientific category to distinguish them from descriptive/interpretive research; the former relying (as they tend to) on observations, with the latter relying (overtly) on the researcher's interpretations. In addition, I have excluded two of the Vogel and Wetherbe (1984) categories, namely, 'empirical' and 'engineering'. The reason for the former is that the term more reasonably describes the *range* of approaches of this type (*cf.*, the argument of Hamilton & Ives, 1982), and in the latter case, the term more reasonably describes the *focus* of the research (*ie.*, the application area) rather than the *approach* to that research. In addition, 'longitudinal' research can be incorporated in other approaches (as will be argued below) and has, therefore, also been excluded.

An attempt has been made to keep the number of approaches in each category to a minimum while, at the same time, providing a useful summary of the range of approaches (*ie.*, I have applied the two criteria of comprehensiveness and parsimony against which Vogel and Wetherbe (1984) measure utility in this context).

3. INFORMATION SYSTEMS RESEARCH APPROACHES: STRENGTHS AND WEAKNESSES[6]

In this section, the key features of each of the information systems research approaches identified in Table 2 will be considered in turn, followed by a consideration of their relative strengths and weaknesses. Table 3, which summarises the key features, strengths and weaknesses, can be found at the end of this section.

6. This section builds on the analysis first described in Galliers (1985). See especially pp. 292-294.

3.1 'SCIENTIFIC' APPROACHES

Laboratory Experiments

The key feature of the laboratory experiments approach is the identification of the precise relationships between variables in a designed, controlled, environment (*ie.*, the laboratory) using quantitative analytical techniques. This is done with a view to making generalisable statements applicable to real world situations. The major strength of the approach rests in the ability of the researcher to isolate and control a small number of variables which may then be studied intensively. The major weakness of the approach is 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 that exist in the real world. Essentially, the value given to those variables excluded from the experiment is zero, which is probably the one value they do not have![7] In addition, much of the research undertaken using this approach utilises students as surrogates for 'real' decision makers, thus adding to the sanitised nature of the laboratory situation.[8]

Field Experiments

Field experiments are an extension of laboratory experiments into the 'real world' of organisations/society. The idea here is, of course, to attempt to construct an experiment in a more realistic environment than is possible in the artificial, sanitised, laboratory situation. Strengths and weaknesses are as in the case of laboratory experiments, but an additional weakness is the difficulty in finding organisations prepared to be experimented on! In addition, replication is problematic, in that it is extremely difficult to achieve sufficient control to enable replication of the experiment with only the study variables being altered.

Surveys

Surveys are essentially 'snapshots' of practices, situations or views at a particular point in time, undertaken using questionnaires or (structured) interviews, from which inferences may be made. Quantitative techniques are often used in analysing responses with a view to identifying significant results[9]. With careful design, surveys are a good means of looking at a far greater number of variables than is the case with the experimental approaches. They can therefore provide a reasonably accurate description of

7. For a debate on the appropriateness or otherwise of the laboratory experiments approach to information systems research, see Jarvenpaa (1988) and Galliers & Land (1988).

8. For a discussion on the *pros* and *cons* of using students as surrogates in behavioural research, see, *eg.*, respectively Khera, *et al.*, (1970) and Copeland, *et al.*, (1973, 1974).

9. For a critique of the application of statistical techniques in information systems research, see Baroudi & Orlikowski (1988).

real world situations from a variety of viewpoints. Given large sample sizes, generalisation of the results may be somewhat less of a concern too. However, little insight is usually gained regarding the causes or the processes behind the phenomena under study. In addition, there remains the likelihood of bias on the part of 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

Another common approach to information systems research in the 'real world' is the case study approach. In some respects, one could argue whether case studies are necessarily a particular form of research approach, given that they are essentially merely a *means* of describing the relationships that exist in a particular situation - usually in a single organisation. However, given that case studies are generally considered to be a form of research, they have been included in this discussion. There could also be some debate as to whether the case study approach should be listed under the 'scientific' banner or should fall within the 'interpretivist' category, especially given the particular 'appreciative system' (Vickers, 1980) or 'cognitive filter' (Simon, 1978) of the researcher. Again, however, I have decided to include it in the empirical/scientific category, since many of its exponents classify it thus (*eg.*, Lee, 1989), often arguing that the approach is based on observable 'facts' which are not open to interpretation.

The strength of the case study approach is that it enables the capture of 'reality' in considerably greater detail (and the analysis of a considerably greater number of variables), than is possible with any of the above approaches. Its weaknesses include the fact that its application is usually restricted to a single event/organisation, and the difficulty in acquiring similar data from a statistically meaningful number of similar organisations - and hence, the problems associated with making generalisations from individual case studies (Spencer & Dale, 1979)[10]. Additional limitations of the approach include the lack of control of individual variables - and hence the difficulties in distinguishing between cause and effect[11] - and, as alluded to above, the different interpretations which can be placed on observations (*sic.*) by individual researchers/ stakeholders.

10. However, as argued in Lawler *et al.* (1985, pp. 241-245), single case studies are helpful in developing and refining generalisable concepts and frames of reference. Further, when multiple case studies are used, it is possible to relate variability in context to constants in processes and outcomes (*cf.*, contextualist research, as advocated by, *eg.*, Lipset *et al.*, 1956; Berg, 1979, and Pettigrew, 1983).

11. The problems associated with distinguishing between cause and effect have been circumvented, to a degree at least, by undertaking longitudinal case study research (Pettigrew, 1983; Vitalari, 1985).

Theorem Proof

The theorem proof category is defined by Vogel and Wetherbe (1984, p.6) as capturing "application areas from fields such as Computer Science that otherwise would not be identified". Given that I have excluded their 'engineering' categorisation from Table 2 for the very reason that it describes an application area of research and not an approach, it may seem inconsistent to retain it. I have done so since it describes reasonably accurately that subset of information systems research concerned with development and testing of theorems at the technical end of the socio-technical spectrum. The strengths of the approach equate closely to the strengths of the scientific method generally, *cf.*, Checkland's (1981) 'repeatability', 'reductionism' and 'refutability', and the precision of the results. The major weakness lies in the limited applicability of this style of research as one moves towards the social pole of the socio-technical spectrum.

Forecasting and Futures Research

Forecasting and futures research represent, respectively, the scientific and interpretivist aspects of this form of research. Forecasting (in the scientific context) relies on techniques such as regression analysis (Draper & Smith, 1981) and time-series analysis (Chatfield, 1984) to extrapolate likely future trends from past data. Conversely, futures research - in the interpretivist context of information systems research - is concerned with "the emergence of new social forms and behaviours, and the development of the so-called information society or information age" (Vitalari, 1985, p.244). It is therefore a particularly appropriate approach when investigating the future societal impacts of information technology. In addition, however, it has also been successfully applied *within* organisations by, for example, Nilles and his colleagues (Nilles, 1984; Nilles, *et al.*, 1983). "In this kind of research, different scenarios, or futures, are postulated and the different aspects of information technology and information systems are identified given these different situations" (Galliers, 1985, p.285). Techniques employed here include, for example, the delphi method (*eg.*, Delbecq, *et al.*, 1975) and change analysis (Land, 1982).

Strengths of the forecasting approaches include the ability to provide insights into likely future occurences (clearly of significant benefit in the rapidly changing world of Information Systems), but these insights are dependent on the precision of past data in the one case and the expertise of the scenario builders on the other. Other limitations relate to the unpredictability of environmental factors and the problems associated with self-fulfilling prophesies identified by Checkland (1981, p.70): "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."

Simulation and Game/Role Playing

Similarly, simulation and game/role playing represent respectively the 'scientific' and 'interpretivist' aspects of this form of research. Simulation is a method "used to solve problems which are difficult or impossible to solve analytically by copying the behaviour of the system under study by generating appropriate random variables" (Chatfield, 1988, p.170). Its particular strengths

are associated with these situations. Its weaknesses relate, as in the case of laboratory and field experiments, to the difficulties associated with devising a simulation that accurately reflects the real world situation it is supposed to replicate. The same can be said for game/role playing, except that the approach is more often used in devising hypotheses to be tested later in 'real world' situations.

3.2 'INTERPRETIVIST' APPROACHES

Futures Research and Game/Role Playing

The futures research and game/role playing approaches have been covered in the above discussion but, as argued, these can also be placed in the interpretivist category of information systems research approaches. In addition, there are in this category: the subjective/argumentative, action research and descriptive/interpretive (including reviews) approaches. Each of these is now discussed in turn.

Subjective/Argumentative Research

The subjective/argumentative category captures (according to Vogel and Wetherbe, 1984, p.6) "creative MIS research based more on opinion and speculation than observation". I have separated it from the futures research and game/role playing approaches because it tends to be more of a free-flowing process (*ie.*, less structured) than either of these approaches. In addition, it is more likely to be an individual, rather than group, activity. Adherents to the 'scientific' school would question whether this form of approach is genuinely research. However, it is included because, in the right hands, this kind of creative process makes a valuable contribution to the building of theories which can *subsequently* be tested by more formal means. Its strengths lie in the creation of new ideas and insights. Its weaknesses arise from the unstructured, subjective nature of the process.

Action Research

The action research approach (Antill, 1985; Wood-Harper, 1985) might be seen as a subset of the case study and field experiment categories discussed above. However, it is included as a separate approach in view of its underlying philosophy which sets it apart from these 'scientific' approaches.[12] This relates to the fact that the action researcher knows that their very presence will affect the situation they are researching. Indeed, their role is to actively associate themselves with the practical outcomes of the research in addition to seeking to identify theoretical outcomes (Foster, 1972). In addition, the roles of subject and researcher can easily be reversed at times during action research studies (Clark, 1972). The strengths of this form of research include the very practical benefits that are likely to accrue to client organisations as a result, and the fact that the researcher's biases are made overt in undertaking the research (White, 1985). Weaknesses are similar to

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

APPROACH	KEY FEATURES	STRENGTHS	WEAKNESSES
LABORATORY EXPERIMENTS	Identification of precise relationships between chosen variables via a designed laboratory situation, using quantitative analytical techniques, with a view to making generalisable statements applicable to real-life situations.	The solution 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 that are found in the real world.
FIELD EXPERIMENTS	Extension of laboratory experiments into the real-life situations of organisations and/or society.	Greater realism; less artificial/sanitised than the laboratory situation.	Finding organisations prepared to be experimented on. Achieving sufficient control to enable replication, with only the study variables being altered.
SURVEYS	Obtaining snap shots of practices, situations or views at a particular point in time (via questionnaires or interviews) from which inferences are made (using quantitative analytical techniques) regarding the relationships that exist in the past, present and future.	Greater number of variables may be studied than in the case of experimental approaches. Description of real world situations. More easy/appropriate generalisations.	Likely that little insight obtained re. the causes/processes behind the phenomena being studied. Possible bias in respondents (cf. self-selecting nature of questionnaire respondents); the researcher, and the moment in time which the research is undertaken.
CASE STUDIES	An attempt at describing the relationships which exist in reality, usually within a single organisation or organisational grouping.	Capturing 'reality' in greater detail and analysing more variables than is possible using any of the above approaches.	Restriction to a single event/organisation. Difficulty in generalising, given problems of acquiring similar data from a statistically meaningful number of cases. Lack of control of variables. Different interpretations of events by individual researchers/stakeholders.
FORECASTING, FUTURES RESEARCH	Use of such techniques as regression analysis and time series analysis, or the delphi method and change analysis, to extrapolate/deduce likely/future possible events or impacts.	Provision of insights into likely future occurrences in situations where existing relationships may not hold true in the future. Attempts to deal with the rapid changes taking place in IT and their impacts on individuals, organisations and society in general.	Complexity and changing relationship of variables under study. Lack of real knowledge of future events. Scenarios are not 'true' pictures of the future but enable decisions re. reactions in different 'futures'. Dependent on precision/relevance of past data and expertise of scenario builders. Possibility of self-fulfilling prophecies.
SIMULATION, GAME/ROLE PLAYING	An attempt at copying the behaviour of a system which would otherwise be difficult/impossible to solve analytically, by the generation/introduction of random variables.	Provision of an opportunity to study situations that might otherwise be impossible to analyse.	Similar to experimental research in regard to the difficulties associated with devising a simulation that accurately reflects the real world situations.
SUBJECTIVE, ARGUMENTATIVE (CF. PHENOMENOLOGY, HERMENEUTICS)	Creative research based more on opinion/speculation than observation, thereby placing greater emphasis on the role/perspective of the researcher. Can be applied to existing body of knowledge (reviews) as well as actual/past events/situations.	Useful in building theory that can subsequently be tested. Creation of new ideas and insights. Recognition that the researcher will interpret what is being studied in a particular way. Contributes to cumulative knowledge.	Unstructured, subjective nature of research process. Despite making the prejudice of the researcher known, there is still the likelihood of biased interpretations, a problem which is compounded by the time at which the research is undertaken.
ACTION RESEARCH	Applied research where there is an attempt to obtain results of practical value to groups with whom the researcher is allied, while at the same time adding to theoretical knowledge.	Practical as well as theoretical outcomes most often aimed at emancipatory outcomes. Biases of researcher made known.	Similar to case study research, but additionally places a considerable responsibility on the researcher when objectives are at odds with other groupings. The ethics of the particular research are a key issue.

Table 3: A Summary of the Key Features, Strengths and Weaknesses of Alternative Information Systems Research Approaches (Amended and extended from Galliers, 1985, pp. 292-294)