

Three approaches as pillars for interpretive Information Systems research: development research, action research and grounded theory

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This paper addresses practical approaches and models, based on the paradigm of the 'interpretivist school', to operationalise research in information systems. The study overviews research paradigms and some current issues in IS research, then describes, discusses and illustrates three approaches, namely, development research, action research, and grounded theory, advocating them as proposed pillars for interpretive IS research. With the present emphasis on user-centricity and empowerment of previously technologically-disenfranchised domains, inquiry processes emanating from the social sciences and humanities are relevant to IS, particularly with relation to interactive systems to bridge the digital divide and for the design and development of emerging technology. Each of the approaches suggested has an underlying theoretical framework and reflective methods, and can serve as a model to guide the research process, offering a unifying thread, cohesion and internal consistency to a research study.

Categories and Subject Descriptors:

H.0 [Information Systems General] Research; H.5.1 [Multimedia Information Systems] Evaluation/methodology

H.5.2 [User Interfaces] Theory and methods, user-centred design;

J.4 [Social and Behavioural Sciences]; K.6.3 [Software Management] Software development

General Terms: Theory, Human factors

Additional Key Words and Phrases: Research philosophy, Research methodology, Metaresearch, Models, Reflection, Human-computer interaction

1. INTRODUCTION

Research design, paradigms and methods are under the spotlight in the Computing discipline, particularly in the domain of Information Systems (IS) [Baskerville, 1999; Baskerville & Wood-Harper, 1996; Cockton, 2004; du Plooy, 2004; Glass, Ramesh & Vessey, 2004; Myers, 2004; Pather & Remenyi, 2004; Roode, 2003; 2004; Travis, 1999; Walsham 1995a; 1995b; Wood-Harper, 1985]. With the increase of 'interpretivist' research, a perspective emanating from the social sciences, this paper addresses practical approaches and models to operationalise interpretive research in IS. Three candidate approaches with methodological rigour, are proposed, namely: development research, action research, and grounded theory.

2. BACKGROUND: RESEARCH PARADIGMS AND METHODS

Different research paradigms and models are based on varying philosophical foundations and conceptions of reality [Cohen, Manion & Morrison, 2000; du Poy & Gitlin, 1998; Lincoln & Guba, 1985; Olivier 2004]. Each paradigm, in turn, is implemented by associated methodological approaches and strategies.

2.1 Positivist and interpretivist paradigms

The *positivist* paradigm holds that knowledge is *absolute and objective* and that *a single objective reality exists external to human beings*. Positivism is equated with the *scientific method*, whereby knowledge is discovered by controlled empirical means, such as experiments. Positivist research is intended to produce an exact representation of reality, *unbiased* and *value-free*. Research results should be reliable and consistent, free from perceptions and biases of the researcher. Findings should be *replicable* by other researchers. Positivist research relies primarily on *quantitative* methods, where data comprises mainly numbers and measurements and analysis is done using statistical methods. Results can be used for prediction. Studies are frequently *hypothesis-driven*. These methods originate from the natural sciences, but are also applied in the social sciences.

Interpretivism, by contrast, aims to find new interpretations or underlying meanings and adheres to the ontological assumption of *multiple realities*, which are *time-and context dependent*. (Terminology is not absolute: An alternative term for interpretivist is 'naturalistic' [Cohen, Manion & Morrison, 2000; Lincoln & Guba, 1985]. Walsham [1995a] refers to the 'interpretivist school', yet as a general adjective uses 'interpretive approaches, -methods, -studies', etc. Travis [1999] and Roode [2003; 2004] prefer 'interpretivist'.) Interpretive research emanated from the social sciences and is also used in educational research. It is now becoming accepted in IS [Roode, 2003; Walsham, 1995a; 1995b]. Inquiry is *value-related* as interpretivism leads to *subjective* findings which may differ between researchers. It is an appropriate view for studies of complex human behaviour and social phenomena. Just as positivism is most naturally

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operationalised using *quantitative* methods (yet not exclusively), so interpretivism lends itself mainly (not exclusively) to *qualitative* studies. Where positivism tests hypotheses, interpretivism investigates *research questions*, focused on understanding phenomena that occur in natural settings (ethnographic) and which use verbal data. Qualitative data collection and analysis produce findings related to intricate details where values and human experiences are relevant. In such contexts, the ability to *interpret* data is important and, in fact, ‘the researcher is an instrument’ [Leedy & Ormrod, 2001:147]. Reliability in qualitative research can be considered as fit between the findings recorded and occurrences in the natural setting. Research methods are frequently triangulated by multiple data collection methods.

2.2 Research methods: qualitative and quantitative

Mertens [1998] describes qualitative research as a naturalistic interpretive science which is multi-method in focus. It involves the use of methods such as case studies, interviews, observation and textual analysis, which provide insights into cultural aspects, organizational practices and human interactions.

Qualitative and quantitative methods are not mutually exclusive. Many studies require eclectic inquiry methods to cover the terrain and provide triangulation. Another role of qualitative research is as exploratory work, setting the foundation for quantitative research. Qualitative findings from basic research in new areas can be used to formulate hypotheses and questions for quantitative analysis, which then yields empirical results to test, verify and extend the qualitative hypotheses. Figure 1 shows leading research methods situated on a Positivist — Interpretivist axis, tending from the quantitative to the qualitative, yet with an overlap.

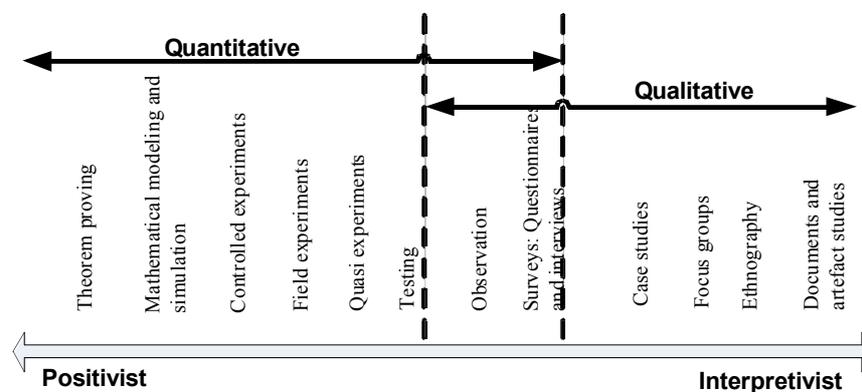


Figure 1 Research methods/strategies

3. FOREGROUND: INFORMATION SYSTEMS RESEARCH

With a view of paradigms and methods as background, we move on to a discussion of information systems research. IS is a multi-perspective discipline and, as Wood-Harper [1985] asserts, it can rightly engage a plurality of research methods. Its domain incorporates scientific, technological, engineering, organizational, managerial, psychological and societal aspects. The subdiscipline of human-computer interaction (HCI) is currently prominent, highlighting the role of the end user, and adding more disciplines: sociology, philosophy, physiology, anthropology, linguistics, ergonomics, graphical design, marketing and engineering. The increasing power and stability of technology has pushed the application of information systems into multiple domains [Pather & Remenyi, 2004], making it appropriate territory for practicing reflective methods and, as Pather and Remenyi propose, IS research needs corresponding reorientation.

Walsham [1995b] examined IS research journals from 1992 onwards, four each from the UK and USA, and noted the advent of *interpretive* studies. In an extensive analysis of computing research, based on a study of selected papers from leading journals between 1995 and 1999, Glass, Ramesh and Vessey [2004] coded 628 papers from Computer Science (CS) journals and 369 from Software Engineering (SE), including the ACM and IEEE publications, as well as other well-recognised journals. They also examined 488 Information Systems papers, mainly from ‘Management’ IS literature. This metaresearch investigated the kind of studies conducted in these three disciplines, noting similarities and differences. For the purpose of this paper, mainly information relating to IS is extracted, but there is brief reference to the other two, where relevant. The IS *topics* focused heavily on organisational concepts (66%) with systems/software management and systems/software concepts next, both at 6-7%. Of the CS papers investigated, systems/software concepts comprised 19% and the SE focused on systems/software (55%) and systems/software management concepts (12%). Each category was further divided into subcategories and it was found that 24% of the IS related to usage/operation and 19% to technology transfer, with other IS papers focusing on the problem domain, e.g. decision support systems and group support. With regard to *research approaches*, 67% of the IS papers used *evaluative* approaches. IS *research methods* were field study (27%), laboratory experiment on humans (16%), conceptual analysis (15%), and case study (13%). Finally Glass et al report on levels of analysis, stating that most of the IS work was related to *behavioural* aspects: organizational behaviour (26%), individual behaviour (26%), and group issues (11%), whereas behavioural analysis in CS and SE occurred in only 2% and 8% of the cases respectively.

Walsham [1995b] and O'Donovan and Roode [2002] attach importance to the editorial policy shift in the journal *MIS Quarterly*, which has expanded its range of research by explicitly calling for papers based on interpretive or integrated, as well as positivist, approaches.

This tendency of IS to take cognizance of human behaviour and to use evaluative approaches is notable. There is a current gravitation, particularly in the HCI subdiscipline, towards user-centric systems, usability support for personal computing, and the empowerment of domains beyond business and management information systems. Systems are being developed to bridge the digital divide, to offer *accessible* computer technology, as well as *emerging technology* and *development software* for the previously technologically-disenfranchised.

Much of the IS research done, is for postgraduate study. Du Plooy [2004] and Roode [2004] held a seminar relating to non-positivist IS research methodologies, with particular reference to doctoral studies. Du Plooy [2004] notes concerns, describing IS research as a 'maturing science' and a 'fragmented adhocracy' lacking theory and methods, which does not fit neatly into the positivist paradigm, especially when qualitative methods are used. IS places a major focus on the unique qualities of information itself, as occurs during enquiry into design, management decisions, and social processes. Du Plooy suggests that academic IS research is often geared to the target audience of the dissertation examiner, rather than the IS community, and that results seldom reach IS practitioners. His consequent *axiology of relevancy* posits that interpretive research is typically weak in clear proposals on how to improve practice and that most IS research shies away from value-laden research issues. PhD students should address practical problems, using sound interpretive and evaluative approaches based on methods such as field studies, semi-structured and unstructured interviews, and ethnographic data. Analysis should be conducted using, for example, grounded theory, hermeneutics, or critical social theory, all of which *contribute to the production and refinement of theoretical frameworks* [du Plooy, 2004]. In line with his notable editorial [Roode, 2003:1] proposing 'acceptance of interpretivist research on a semi-equal footing with positivist research', Roode [2004], referring to Hirschheim and Klein [2000], addresses the intellectual state of IS research, with its internal and external views. The internal view of the IS research community indicates fragmentation, particularly due to the paradigm war between interpretivists and positivists. The external view relates to the gap between IS research and industry expectations, where current research is insufficiently relevant to practice and links between academia and industry are inadequate. Research outputs produce a plethora of *ad hoc* findings, yet lack generality and pluralism nor do they broaden theoretical constructs. Roode promotes a *broadened notion of relevancy*. While the accepted scientific method – entailing hypethetico-deductive studies – is relevant, non-positivist forms of scholarly research should not be excluded.

Regarding postgraduate research in general, Mouton [2001] points out the multidisciplinary and heterogeneous nature of current knowledge. He further cites methodological difficulties as a major factor in the non-completion of postgraduate studies.

In this milieu, the contribution of the present paper is to suggest three practical, methodologically- and theoretically sound approaches for conducting interpretive research in IS. Each emanated from the social sciences and humanities, yet is applicable to research in computing disciplines, where the design of human-computer interaction is highly relevant in a society and economy increasingly geared to user-centric values. The approaches are applicable to postgraduate studies, as well as to basic, ad hoc and contract forms of IS research.

4. FOCUS: INTERPRETIVE INFORMATION SYSTEMS RESEARCH – THREE APPROACHES

Against the context set by Section 3, this section focuses on theoretical frameworks to underpin IS research. A precedent occurred in SAICSIT 2004, where Pather and Remenyi [2004] proposed critical realism as an appropriate approach to bridge the gap between the positivist and interpretivist paradigms, using both qualitative and quantitative techniques. This present paper suggests further approaches, highlighting models and methods that primarily implement the ethos of the interpretivist school. When conducting IS research, an explicit theoretical framework or conceptual model should, ideally, support the study and provide internal continuity and cohesion in the reasoning process.

We first briefly address research terminology, with its plethora of overlapping, exclusive, interrelated and, at times, confusing terms. To clarify matters, a taxonomy of terms follows, explaining their usage within this study (other authors may well use them differently):

- Paradigm – the primary philosophical point of departure: in this study, the *interpretivist* (rather than positivist) stance.
- Approach – the underlying model used to operationalise the study: the approaches suggested here being *development research*, *action research*, and *grounded theory*.
- Methods – practical means/strategies/techniques/instruments used for data collection: each approach has its own set of methods, usually multiple methods and often hybrid methods.
- Adjectives to describe the methods: some methods are qualitative and others quantitative.

With the acknowledgement that computing has human and sociological, as well as technological and computational dimensions, particularly in Sub-Saharan Africa with its technologically-unempowered groups, research methods from the interpretivist paradigm have a definitive role to play. Preece et al [2002] distinguish between the usability and user experience of software systems. The latter, in particular, lends itself to interpretive and qualitative analysis.

This section of the paper describes, discusses and illustrates development research, action research, and grounded theory, and their application in interpretive IS research. Each of the three has associated methods and techniques to operationalise it. The proposals culminate in a diagrammatic ‘Pillars Proposal’ for IS Research.

4.1 Development research

4.1.1 Definition and origins

Development research (DR), also called research with a development goal, has a dual focus. It:

1. develops practical and innovative ways of *solving real problems*, and
2. proposes general design principles to *inform future decisions*.

DR is not to be confused with ‘developmental research’, which relates mainly to sustainable development in the context of transformation and community issues in developing countries. The approach [Reeves, 2000; van den Akker, 1999; 2002], which aims to make both practical and scientific contributions, originated in educational technology research, giving graduate students and researchers support in pursuing development goals after decades of research with empirical goals. It is also applied in curriculum research, where some of its key concepts emerged. It is not yet a mainstream IS research approach. Other candidate approaches for development goals have drawbacks. *Postmodern perspectives* and *critical theory* address inherent problems (particularly injustices), but do not necessarily improve conditions. *Action research* (Section 4.2) is not always explicitly geared to producing new solutions and is not always generalisable. *Development research* is problem-oriented, searching for new and innovative solutions, while also seeking findings that are transferable, practical, and socially responsible. DR acknowledges the complex and dynamic relationship between theory and application, and aims to provide a relevant foundation to guide practice by generating design principles and methods that are both theoretically underpinned and empirically tested.

4.1.2 Research process and methods

Development research generates different kinds of research questions. A *descriptive* research question examines the nature and extent of a problem, while a *design/development* question investigates an intervention or new product to address the need. A *principal* question inquires into generalisable principles and guidelines for the application domain.

The process commences with the analysis, design and development of an artefact or intervention as a solution for a real-world problem. This, in and of itself, is not yet research (though many postgraduate students wish it was!). It becomes research when the design-and-develop project is conducted from the perspective of a researcher striving to understand the issues of the application domain and its target users, such as the required characteristics of products and artefacts. Such research is based on iterative analysis, design, development, implementation and formative evaluation (ADDIE – an instructional technology design model), which feeds into redevelopment. DR is closely related to evolutionary prototyping, and entails formative research during the development process of the intervention/product to improve its quality. Van den Akker [2002] terms the process ‘successive approximation of the ideals’. Evaluations can be done by one or more usability evaluation methods, e.g. formal usability testing in a laboratory, logging, surveys among end users, observation, etc.

There are various models of the DR process. The model used by Plomp and his co-researcher, van den Akker [van den Akker, 1999; 2002; Plomp 2002] refers to outcomes of an intervention. *Immediate outcomes* relate to results of using an intervention or product within the cyclic process, and *distant outcomes* emerge when the immediate outcomes lead to distant outcomes in the form of generalisable principles. Reeves’ [2000] model emphasises the iterative interaction between researchers and practitioners to clarify the problems and refine potential solutions in a process of evolutionary prototyping. Plomp’s and Reeves’ models both influence the representation in Figure 2.

4.1.3 Epistemology of DR

Development research has a pragmatic epistemology as it acknowledges collaborative shaping by researchers and practitioners. Van den Akker [1999], describing the knowledge acquired from DR, distinguishes between:

- *Substantive* design principles, relating to the generic characteristics of suitable interventions or *products*.
- *Methodological* aspects, with a procedural emphasis, suggesting optimal development *processes*.

In formative research a great deal of such knowledge is inductively extracted from the experience of using and evaluating the prototype developed for the study. This provides a link between the two branches of the dual development focus, namely the developing solution to a specific problem and the evolution of generalisable design principles. The experiential evidence obtained from studying the prototype in use in its various iterations, is enhanced when integrated with theoretical arguments.

4.1.4 Application within IS

Many IS studies involve the generation of software artefacts or web-based applications. These vary, for example, from simple prototypes through interactive web sites with backend databases through to virtual reality simulations. Design, implementation and testing comprise the focus area of *development* but are not *research*. The introduction of *evaluation*, where evaluation entails more than mere testing of functionality, constitutes a meaningful contribution to the body of knowledge. However, dual-focused research producing both an effective solution and generalisable principles for the application domain, enriches the process even more and is a useful approach for a variety of studies in domains such as e-learning, e-commerce, e-health, etc. A product – often a prototype – can be custom-built as a solution to a problem and iteratively evaluated and refined, as described by Conradie and de Villiers [2004]. DR has

also been used for computer-based support materials, and is relevant to computer science and engineering as well for generating hardware solutions and associated generic principles.

Figure 2 is a generic model of the DR process. Its iterative phases can be effectively used to structure an IS research process, providing continuity and cohesiveness.

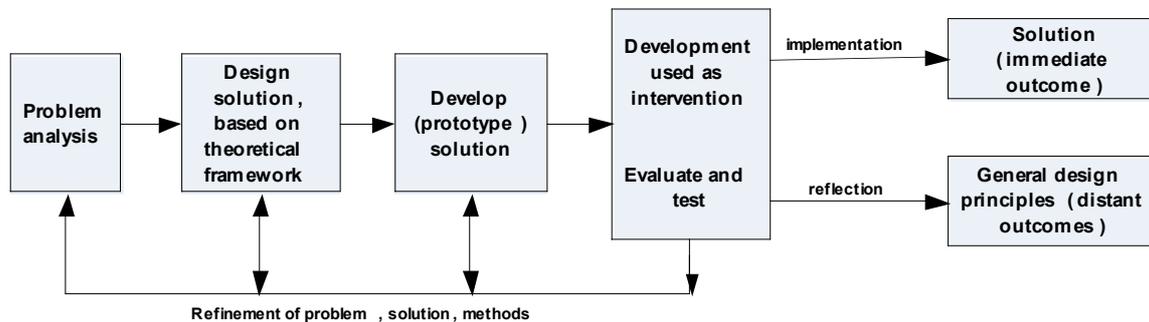


Figure 2 Development research model (synthesized by the author, influenced by Plomp [2002] and Reeves [2000])

4.2 Action research

4.2.1 Definition and origins

The action research approach [Baskerville, 1999; Baskerville & Wood-Harper, 1996; Cohen, Manion & Morrison, 2000; Zuber-Skerrit, 1992] emanates from the behavioural sciences and encompasses a variety of research and intervention methods. Action research (AR) originated in action-based social psychology. Its founder in the 1940s, Kurt Lewin of the University of Michigan, contended that complex real social events could not be investigated under laboratory conditions [du Poy & Gitlin, 1998; Wood-Harper, 1985]. AR was used independently at the Tavistock Clinic to study post-WW2 social disorders among veterans [Baskerville, 1999]. Zuber-Skerrit [1992] defines AR as inquiry by higher-education academics into problems of students learning. Its participative, practitioner-researcher approach lends itself to the domain of educational research, where an evolving intervention or product is investigated over several cycles. It is appropriate for inquiry into educational technology and for investigating the introduction of technologies into any organizations.

Aiming to bridge the gap between research and practice, AR encompasses *action outcomes* and *research outcomes* [Dick, Passfield & Wildman, 1995]. Commencing with the identification of a problem or situation that calls for action, AR functions as a liberating *agent of change*, and is [Baskerville, 1999; Dick, Passfield & Wildman, 1995; du Poy & Gitlin, 1998]:

- *Cyclic*: as iterative steps recur in a longitudinal time frame, generating knowledge to inform further action.
- *Participative*: as clients, end users and researcher collaborate in partnership as co-researchers, or as practitioner-researchers examine their own work. Where stakeholders are full participants in the research process or where practitioners serve both as subject and researcher, one refers to *participative action research*.
- *Qualitative*: operating more via verbal aspects than by numbers.
- *Reflective*: since critical reflection on the process and outcomes is vital to each cycle, and is used in designing subsequent steps and events.
- *Responsive*: as it reacts and adapts flexibly to the findings from each previous cycle.

In a parallel from the professional disciplines, Schön [1987] defines reflective practice or *reflection-in-action* as the professional artistry that occurs when skilled practitioners tackle work-related activities, going beyond rigid rules of inquiry, and generating new rules in situations that are uncertain and unique. Furthermore, the *reflective practitioner* is both a participant in the process and a critic who observes and analyses. Similarly, AR aims to improve practice and advance knowledge.

4.2.2 Research processes and methods

Zuber-Skerrit [1992] terms the four repetitive processes undertaken in each cycle as *plan, act, observe, and reflect*. The megaprocess comprises a series of cycles that feed into each other. AR is accordingly more of an ongoing process than an event. Du Poy & Gitlin [1998] state that action research employs or integrates methods from both the experimental and naturalistic (interpretivist) traditions, yet is consistent with naturalistic inquiry in that all research occurs within its natural context. Kock et al [2000], emphasizing rigour in research, contend that effective use of an iterative approach to AR can provide rigour of a standard acceptable even to positivists.

4.2.3 Epistemology and philosophy of AR

Its ethos is interpretivist, incorporating social enquiry based on the views and interpretations of the participants, all regarded as equals, making it an emancipatory process, while also incorporating the researcher as participant. It is a

holistic, not a reductionist, approach, which includes ethnographic enquiry and works from an ideographic standpoint, promoting the uniqueness of each setting [Baskerville, 1999]. At the time when AR originated, emphasis was placed on the precise collection of quantitative data and there was a shortage of qualitative research skills. In due course, it was recognised that AR operated under a different epistemology and, although it can be less rigorous in design and methodology than other approaches, it came into its own as a human-related research process which generates reliable knowledge.

Action research differs from development research in that first, it operates over a longitudinal time framework of several cycles and, second, in the in-depth involvement of researcher as participant. Third, it may well focus on refinement of existing processes or products and not necessarily on new product development.

4.2.4 Application within IS

AR is a valid research approach for applied fields [Myers, 2004]. Baskerville [1999] asserts that the AR approach generates highly relevant research results due to its basis in practical action, aimed at explicit problem solving while also informing theory. In the 1980s, AR techniques were applied by Peter Checkland in systems analysis, as he developed soft systems methodology, i.e. use in development, rather than in research [Baskerville, 1999].

IS research has been characterised by lack of relevance [Keen, 1991; Westfall, 1999; both cited by Baskerville, 1999]. In the previous decade, however, Trevor Wood-Harper had already set out to address the tensions between theory and practice and the confusion that existed between traditional scientific research and the more sociological approaches, by introducing AR to the IS community as a purely research methodology with his landmark paper, *Research Methods in Information Systems: Using Action Research* [Wood-Harper, 1985].

AR is increasingly used for scholarly research in IS. Baskerville [1999] advocates it to inquire into the complex and multivariate nature of IS's social setting, using:

1. Joint goals of solving practical computing problems and expanding scientific knowledge.
2. Collaborative performance, which enhances the competencies of all participants.
3. An emphasis on action and change orientation in social settings.
4. Systematic, iterative stages.

Baskerville lists forms of IS action research: prototyping, soft systems methodology, action science, participant observation, fieldwork, and process consultation. The present author adds investigation of evolving solutions in their context of use, e.g. e-learning applications and customised interfaces, where the designer conducts research into his/her own product. AR for producing e-learning solutions is also advocated by Derntl & Motschnig-Pitrik [2004].

Action research can be graphically depicted as a spiral, but the model developed for Figure 3 is a series of cycles which close in as a solution is attained. The researcher occupies a central, participative, and influential position. This model forms a useful framework to guide and monitor the progress of a research project.

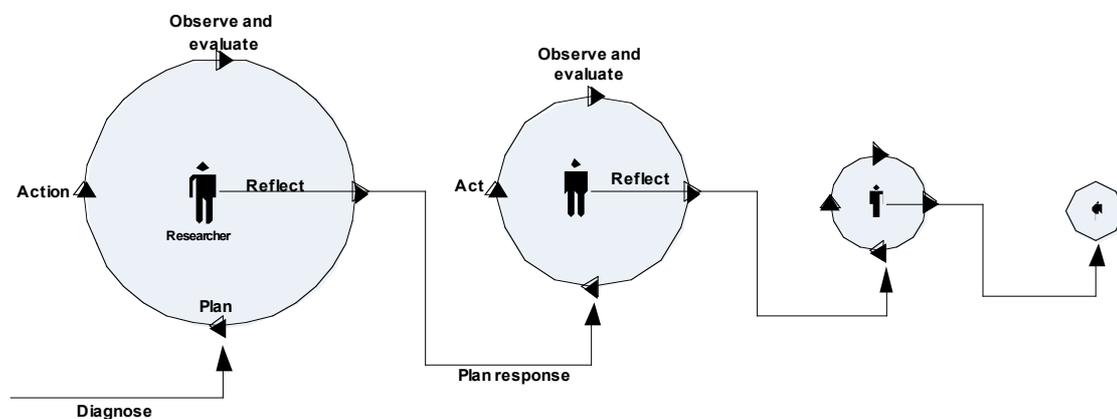


Figure 3 Action research model (synthesized by the author)

4.3 Grounded theory

4.3.1 Definition and origins

Grounded theory [Cockton 2004; Glaser & Strauss, 1967; Glaser, 1992; Leedy & Ormrod, 2001; Strauss & Corbin, 1990] is an approach in which theory and models are generated inductively from the analysis of contextual data. Grounded theory (GT) involves the discovery of concepts and hypotheses as theory emerges from data. There is no testing or replication of a-priori theory. Like action research, it has roots in social science, but specifically in sociology, where attitudes to conditions (initially attitudes to death) were investigated by Glaser and Strauss. Strauss and Corbin [1990] describe its extension to anthropology, education, nursing and the economic sciences. Cockton [2004] uses it in the design of computing interactions. It provides a conceptual grasp of substantive areas, which evolves and is modified to fit as findings emerge and new data occurs. GT should account for variation in domain behaviour by defining categories, properties and relationships. The data may be quantitative, qualitative or a combination, but in the

case of qualitative, it is essential that it be systematically collected, analysed and coded. Defined sets of methods should be applied so that a grounded theory emerges systematically and inductively through covariant ongoing collection and analysis. Lincoln & Guba [1985] state that a GT is adjusted, expanded, and refined via this ongoing process.

As with AR, there is a parallel from the social professions. The notion of emerging patterns has an analogy in Christopher Alexander's *patterns* within architecture and town planning, which form practical architectural languages, as physical and social relationships articulate themselves [Alexander, Ishikawa & Silverstein, 1977]. Within a *pattern language*, it is also possible to integrate overlapping patterns in a *densifying* process, which provides added meaning.

The four criteria for a well-constructed grounded theory within a substantive area are:

Fit: its categories and their properties should fit the realities being studied.

Work: in order to work, it should explain variations in behaviour.

Relevance: this is achieved when a grounded theory both fits and works.

Modifiability: the emerging theory is open to adaptation as new data and variations are integrated.

4.3.2 Research processes and methods

Covariant data collection and analysis, which are methods from the social sciences, entail initial interviews and fieldwork, which after transcription, coding and analysis delimit the field, prompting theoretical sampling methods and densifying [Glaser, 1992]. Other methods [Strauss and Corbin, 1990] are observation, document analysis, historical records, and videotapes, which reflect perspectives of the subjects of study. GT integrates quantitative and qualitative perspectives [du Poy & Gitlin, 1998]. Back-and-forth mobility occurs between data collection and analysis, with analysis driving collection. Patterns are identified and conceptualized as the researcher codes, compares, analyses and records. *Constant comparative coding* [du Poy & Gitlin, 1998; Glaser & Strauss, 1967; Glaser, 1992] is the validation process whereby observations and behaviours are compared/contrasted with core categories and properties, then coded into categories. The developing conceptual model is modified as new data is explored and new concepts are integrated into the emerging theory, reviewing and expanding where necessary. When multiple behaviours indicate similar patterns and properties, *saturation* has occurred. When disconfirming evidence is found, revisions are required. In this way the emerging theory is inductively discovered, bounded and confirmed. Lincoln and Guba [1985] suggest the generation of *alternative theories*. As the researcher encounters confirming cases, negative cases and discrepant cases, the theory with the most confirming cases and the least negatives and discrepant, emerges as the most robust. GT thus has similarities to case study research and ethnography, since both the latter aim to detect and interpret patterns within activities and events.

4.3.3 Epistemology of GT

The researcher's bias and subjectivity may influence conceptualization and interpretations. However, grounded theory has built-in mechanisms to prevent this, such as constant comparison, saturation and core relevance [Glaser, 1992]. Furthermore, data collection, analysis and presentation to peers should be linked at each step, adjusting one another to the emergent theory and preventing forcing.

The Glaser model posits, contentiously, that so as not to force or make preconceptions, there is little initial need to review literature. Once the emerging theory is sufficiently grounded in core variables, literature reviews in the substantive field can commence and be related to the new work. Where new fields are opened the researcher, according to Glaser, is a 'pre-empting pioneer', producing a new general theory to be integrated with other literature. Scholarship starts and expands as the emerging grounded theory develops. Glaser claims that this approach also obviates the problem of more and more to read and less time to do!

4.3.4 Application within IS

Orliowski's [1993] award-winning paper in an issue of the MISQ describes a project in which a grounded theory research approach was used to study organizational experience with the adoption and use of CASE tools. Findings were used to develop a theoretical framework conceptualizing organisational change and social issues in such cases, where installation involves not only new technologies, but also organisational change over time. GT was a relevant approach, because of its emphasis on contextual elements, process management, and human actions.

Cockton [2004] discusses the applicability of grounded theory to computable interactions, and explains how, as theories and themes emerge, corresponding models can be defined and implemented using an HCI contextual approach. Such models could include *personas*, *scenarios* and *sequence models*, where the persona describes a stereotypical user and the scenario a stereotypical usage. It is a rich context-centred approach, which takes account of users' goals and aspirations, aiming for high relevance. The models, in turn, are used in design to generate prototypes, following which the fit between context of use and interaction surfaces can be tested and mediated. Thus grounded theory research in IS investigates data, resulting in theory, which leads to models, which lead to innovative *grounded designs* or *design models*, which satisfy 'fit to context' [Cockton, 2004].

The GT process can be applied in studies that focus on the *extraction of design guidelines* by analysis of practice or best practice in substantive areas, synthesizing them into theoretical proposals, which are further refined, tested and

ratified by use. This is being done in certain South African postgraduate studies currently in progress. The associated generation of design principles and evaluation criteria for software applications and web site development is a notable role for GT in information systems research and development.

Glaser's [1992] concept of pre-emption is appropriate in the emerging Southern African technological domains where innovative work is underway. Particular examples are the design of non-standard interactive environments, such as development software explicitly for the formerly disadvantaged, emergent information systems, culturally-sensitive environments, and contextualized e-learning and training. Projects are being conducted which use technology in orientation, training, and the provision of information in low-literate communities. Research on culturally-sensitive interfaces has been extended beyond the workplace, to address accessibility for under-educated indigenous peoples.

Figure 4 graphically illustrates the processes and concepts of GT. This model can serve as an underlying framework for IS research processes which investigate phenomena to determine their underlying theory and to derive principles.

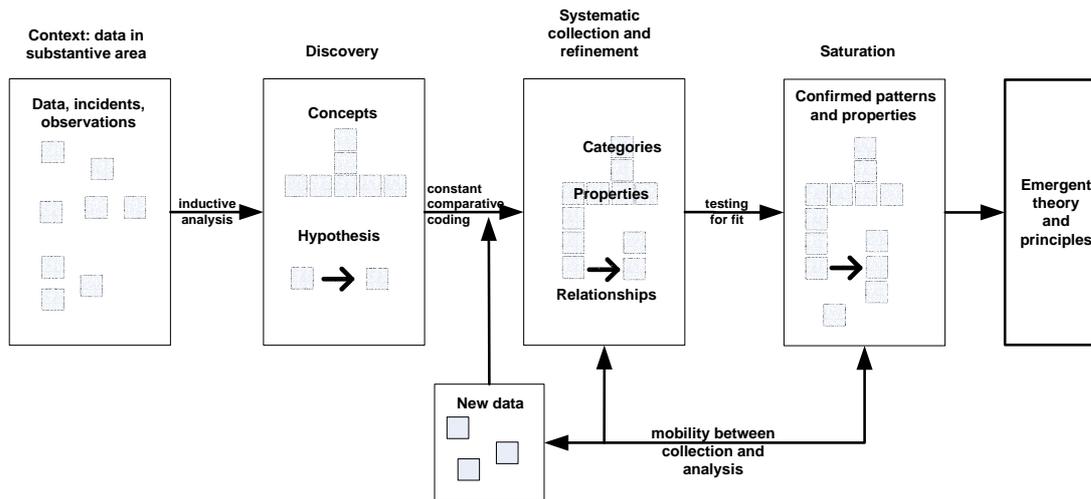


Figure 4 Model of grounded theory emergence (synthesized by the author)

4.4 The 'Pillars Proposal' as a framework

Although simplified representations can hold the risk of trivialization, Figure 5 summarizes and consolidates this paper with a synthesized structure entitled *Proposed Pillars for IS research*. The three research approaches advocated are depicted as *pillars* on an interpretivist *platform*. Within each pillar, key concepts and possible applications are concisely listed. Supported by the pillars is a *pediment* of interpretivist IS research. These pillars are particularly relevant for genres of IS research focused on systems intended for end users who are not computing professionals, and for milieus where the IS researcher is not restricted to working in an organizational environment. Examples are the investigation of software or web applications for personal computing, and systems for the empowerment of learners or indigenous peoples.

This diagram is not intended to be exclusive: other interpretive approaches exist, other pillars could be included, and there is also considerable scope for positivist IS research. Nor is it the intention that the three suggested pillar approaches should be used simultaneously; they are presented as options for the researcher.

Walsham [1995a:76, citing Eisenhardt's (1989) discussion on theory in organizational research] stresses the role of theory in interpretive IS research. He identifies 'three distinct uses of theory: (i) as an initial guide to design and data collection; (ii) as part of an iterative process of data collection and analysis; and (iii) as a final product of the research'. From Sections 4.1, 4.2 and 4.3, it is evident that each of the pillars, DR, AR and GT respectively, meets the first criterion in terms of offering a basic research design. With regard to the second required use of theory, Figures 2, 3 & 4 portray iterative collection, evaluation/critical reflection and analysis as key tenets of the three approaches. And, finally, each of the three aims to generate some form of new theory or generalisable principles as a product/byproduct of research.

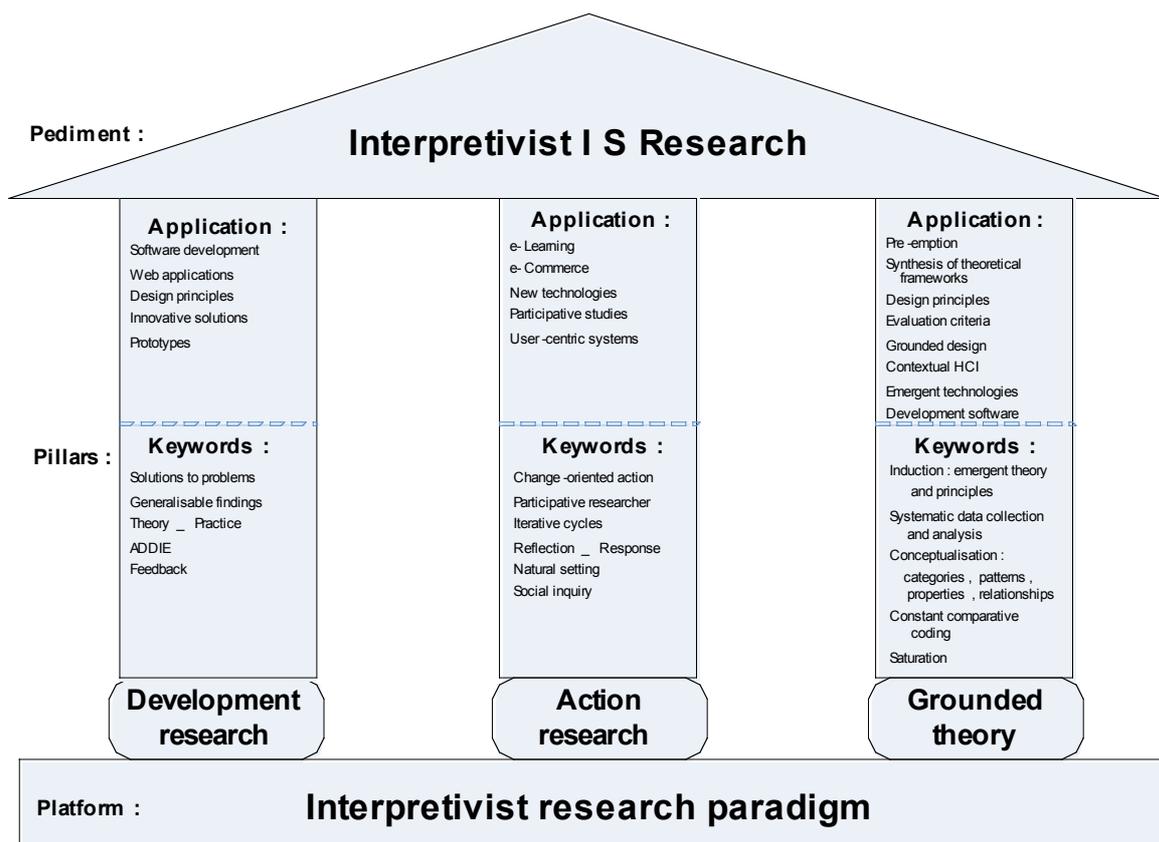


Figure 5 Proposed Pillars for IS research

5 CONCLUSION

Certain research issues are best suited to interpretive and context-dependent approaches. For situations where human performance and social inquiry are relevant, this paper suggests three approaches, or models, as proposed pillars to operationalise the interpretivist research paradigm. Development research, action research and grounded theory all provide theoretical frameworks and methodologies to guide a research project, providing internal continuity and consistency as the study progresses. When one of these approaches is used as a model, the activities, relationships, and reasoning entailed in the research process should be explicitly linked to the selected approach, so that its framework dictates the steps. Regular textual and diagrammatic reference to the model in the written document can enhance the study, providing a unifying thread, both for the researcher and the readers.

I have used (or am in the process of using) each of the three – personally or with students – after literature encounters had indicated its suitability for the study in hand. Enriched by reflection and experiential knowledge, I undertook further in-depth literature surveys, which confirmed the utility of the approaches. The literature also mentions other interpretive means such as case studies, critical theory, descriptive studies, document analysis, ethnography, field studies, focus groups, hermeneutics, phenomenology, role play and semiotics [du Plooy, 2004; Olivier, 2004; Travis, 1999; Walsham, 1995a; 1995b]. However, action research and grounded theory are consistently advocated. One of the sources studied was Michael Myers' detailed, hyperlinked overview of *Qualitative Research in Information Systems* [Myers, 2004], which converges closely with the present independent suggestions. He recommends the approaches of (i) action research, (ii) case studies, (iii) ethnography and (iv) grounded theory. The first and the fourth confirm two of the present pillars, while the both the second (case studies) and the third (ethnography), relating to field-based and contextual studies, can be used as methods within the pillars proposed here. However, the development research pillar appears to be unique to this present study, and holds high utility for future application in information systems research.

The advent of personal computing and the emergence of the HCI subdiscipline are changing the nature of information systems and hence the forms of IS research. The findings of academic research and real-world best practice should inform each other. The social inquiry research approaches outlined in this paper have the potential to impact on performance in interactive computing systems. Findings should contribute to development theories and real-world systems, should generate design principles and evaluation criteria, should encourage sound interaction practices, and can help to support bridges over the digital divide.

Note: For some who may be unfamiliar with terminology, a few words are explained in a glossary after the references.

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GLOSSARY

Empirical: Based on the results of experiments and/or observations, not based on theory.

Epistemology: Theory of the grounds of knowledge, how knowledge is produced, basis of claims to knowledge.

Hermeneutics: The science of interpreting the intention of the original author or researcher.

Methodology: A set of methods used in a process of inquiry.

Ontology: The science of the essence of being; closely related to one's view of reality.

Paradigm: The underlying philosophy and assumptions that form the foundation to one's approach and methodology.

Substantive: Having a separate and independent existence, not merely inferential or implicit.