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The applicability and scientific rigor of case studies in Information Systems [1]

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Abstract:
The aim of this work is to explore the knowledge about *case study* as a research technique in the IS field. Among qualitative methods, it has proven to be valuable for exploring the relationship between information systems and users' perceptions and behaviors, the theme of many current investigations. From the analysis of major works conducted in the area using case study, we intend to work out a series of steps, a guide, to conduct a research project. We believe the lessons compiled in this work, though still in a learning stage, are a contribution to research work involved with the use of case studies. The search for a more rigorous scientific application of qualitative methods in research – such as case study – is a way to bring more powerful results.

Keywords: Information systems - Qualitative Research Methods - Case Study

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The Applicability and Scientific Rigor of Case Studies in Information Systems

1. Introduction

"Science is far from being a perfect tool of knowledge. It is just the best one we have" (Carl Sagan, 1996).

Knowledge construction is marked by an unremitting search for evidence to confirm formulated hypotheses. Thus, in order to face the complexity of the real word and detect its invisible structures, we have to use methods. Without methods, science does not progress, organizations even less. Indeed, science feeds on its own mistakes, discovered not by chance, but through the systematic pursuit of better explanations for natural and social phenomena.

In the Information Systems area, the evidence we search for is included in a context resulting from the interaction between man and computer. That is why a socio-technical perspective is assumed: human aspects (cognitive, psychological, social, cultural, etc) and technical aspects (ergonomics, project, etc) must be accounted for in an integrated rather than an isolated way.

The need to investigate the relationship between computerized systems and their users' (individuals or groups) perceptions and behaviors leads us to explore a number of research methods rather than to assess impacts and methods of system development unilaterally. The scientific rigor expected to be attained in the area of Information Systems as a scientific discipline suggests we should not be confined to an exclusive approach, namely, the quantitative one, but attempt to explore a variety of methods, especially qualitative ones (case study, action research, participation research, etc.). Only then choices can be made, possibly combining quantitative and qualitative methods.

Among qualitative methods, we can highlight the importance that *case study* and *action research* may have in the Information Systems area, especially if we pursue a more rigorous application of these methods. Such scientific rigor will speed and deepen the advance of the knowledge about human-computer interaction and permit the consolidation of the Information Systems area as a scientific discipline.

The aim of this work is to suggest case study as a method not only applicable with rigor from the scientific point of view, but also suited to conduct a number of present investigations in the area of Information Systems. Based on the experiences of researchers and the difficulties, successes, and guidelines they reported, our goal is to assembly a set of principles to be followed step by step in applying the case study method. The

resulting schedule will be followed in one of our studies and, we believe, may be valuable for other researchers intending to use this methodology in their work.

To approach the topic, we present in section 2, a literature review of the case study method on the basis of articles whose contributions to the theme are considered important. Section 3 presents a research project, over section 4 we evaluate if the arguments used are enough to justify the adoption of the case study method for the proposed application. In section 5, we describe *how* case study may be applied to the referenced project, and we present some conclusions in section 6.

2. Background: Case study method according to a number of authors

> *"Whenever a scientific article presents some data, these are accompanied by a margin of error – a silent, though insistent, reminder that no one knowledge is complete or perfect. It is a calibration of our degree of confidence on what we think we know. If the margins of error are small, the accuracy of our empirical knowledge is high; if they are large, so is the uncertainty of our knowledge" (Sagan, 1996).*

Every research strategy has advantages and disadvantages. None can always be considered as most appropriate. A number of authors analyze case study as a qualitative technique used in the Information Systems area. Below we introduce some approaches to the theme that will guide the identification of the main steps to be employed in a research project like the one presented in Section 3.

2.1 - *Case* strategy in information systems studies: Benbasat,Goldstein & Mead [2]

> *"The selection of a research strategy depends on the current knowledge of a topic and the nature of the topic, among other factors. The case strategy is particularly well-suited to IS research because the technology is relatively new and interest has shifted to organizational rather than technical issues" (Benbasat, Goldstein & Mead, 1987).*

In this section we present the major ideas of the authors (Benbasat, Goldstein and Mead) about case study, a methodology considered as particularly suited to certain types of problems, such as those in which research and theory are at an initial stage or based on practice, when actors' experience is important and action context is critical.

Three major reasons justify the use of case study as the most appropriate strategy in a given research context:

- the possibility of studying information systems in the natural environment, of learning about the state of the art and producing theories from practice;
- the possibility of answering questions like "how?" and "why?"; i.e., understanding the nature and complexity of the process under investigation;
- the possibility of investigating an area in which few previous studies have been undertaken.

[2] BENBASAT, Isak; GOLDSTEIN, David and MEAD, Melissa. *The Case Research Strategy in Studies of Information Systems*. MIS Quarterly, v. 11, n. 3, 1987, p.369-387.

Case study is defined as one that examines a phenomenon in its natural setting by applying a number of data collection methods in order to get information from one or more entities. This research strategy is of an exploratory nature, and no experimental or manipulative control is used. In addition, the borders of the phenomenon are not clear.

The results of the study depend largely on the researcher's power to integrate the outcomes, on his or her ability to select the site, and on the methods for data collection, as well as on his or her ability to make changes in the research design in a timely manner.

By comparing the role played by the researcher in different methodologies, we can see that: (1) in laboratory experiments, the researcher measures dependent variables as he manipulates independent ones in a controlled environment; (2) similarly, field experiments involve measurement and manipulation of clearly defined variables, yet in their natural environment; and (3) finally, in case studies, there is no clear definition *a priori* of which variables will be of interest and of how they will be measured, and no control or manipulation is involved: researchers will observe dependent and independent variables in their natural environment and then design their study.

Three categories of qualitative research that are usually classified as case studies. Only one of them, however, is considered by Benbasat, Goldstein and Mead as an actual *case study*. The remaining ones are called *application description* and *action research:*

- *Application description* details the author's experience in implementing a particular application. Results usually report success and the work is concluded with a series of guidelines. In this case, the author has not conducted research but an *implementation*.
- In *action research*, the author participates in the implementation of a system and at the same time performs some technical *intervention*. From the start there is the intention of conducting research. The researcher has two aims: act to solve a given problem and contribute to a set of concepts on Information Systems (IS);
- In *case studies*, the aim is clearly to conduct research, and researchers are investigators-observers, not participants.

The assertion that the basic difference between *case study* and *action research* lies in the intervention of the researcher may be accepted as valid. However, the distinction made above between *application description* and *action research* can be challenged: in both cases, there was intervention, there was participation; and the a priori existence of intention to do research is a factor of delicate evaluation.

Having a specific research question in hand, and case study defined as the third category described above, it is advisable to check whether case study is really the most appropriate and useful methodology to be used. For such purpose, the following questions can be asked:

Question	**Answer**
Can the phenomenon of interest be studied out of its natural environment?	No. A rich natural environment is considered fertile to generate theories.
Does the study focus on contemporary events?	Yes. The *case* methodology is clearly useful when the natural environment is necessary, and when it focuses on a contemporary event.
Is control or manipulation of individuals or events necessary?	No. When people or events must be controlled or manipulated on the course of a research project, case study is not recommended.
Does the phenomenon of interest have an established theoretical basis?	No. The phenomenon under investigation is not supported by a strong theoretical basis, and then must be truly pursued through research.

The *unit of analysis* in case studies may be composed of individuals, groups or organizations, or even projects, systems or specific decision processes. The definition of the unit of analysis should be the result of a careful examination of research questions. When research is highly exploratory, a single case may be useful as a pilot study. In such context, the aim may be to determine the proper unit of analysis and acquaint the researcher with the phenomenon.

That is, it is essential that the researcher decide between using single case or multiple cases. According to Yin (1984), *single case* is suitable when:

- it is revealing; i.e., a situation that is predictably inaccessible to scientific investigation;
- it stands as a critical case to test a well formulated theory;
- it is extreme or unique.

Multiple cases are useful when the purpose is to describe a phenomenon, to build a theory or to test a theory. Concerning research site, a project with multiple cases can be considered as analogous to the replication performed in traditional multiple experiments.

Yin (1984) suggests two criteria to *select* potential *sites*:

- sites where similar results are predicted can be used as *literal replications;*

- sites where contradictory results are predicted can be used as *theoretical replications*.

With a careful *selection*, researchers may expand or review the initial propositions of the study. The initial criterion for selection may be the topic's nature. Researchers who are interested in specific technologies, system methodologies or organizational structures must consider these characteristics in selecting the most appropriate sites to conduct research.

As for *data collection*, case studies typically employ multiple methods. The ideal is that data and evidence can be collected from two or more sources, which can converge and support research findings. We can identify some useful sources for data collection (Yin, 1984):

- documentation: written material, from memoranda to formal reports;
- recorded files: organization charts, financial, personal or service records;
- interviews: open or closed;
- direct observation: observation and notes of details, actions and subtleties of environment;
- physical equipment: mechanisms, tools.

Thus, the goal is to obtain a rich set of data involving the specific research question and capture the complexity of the context. Before paying any visits, the researcher must clearly specify the data he is trying to obtain. This includes listing the materials that will be collected (documents, files and equipment) as well as interview questions and direct observation plans. The aim is to ensure good coverage of research questions and use of time.

It is important to highlight that *data collection* methods depend largely upon the researcher's ability to integrate them. The multiple methods of data collection offer the opportunity to triangulate [3] and strengthen researcher's conclusions.

Data reporting is, of course, also important. The richness of data and context should not be lost. The researcher's reasons for establishing causes and effects or in formulating hypotheses must be clearly stated and supported. The following schedule can be followed: objectives, research issues, assumptions, method, data, results, and conclusions.

Some strengths and weaknesses were detected in performing case studies, according to a critique by Benbasat, Goldstein and Mead (1987) of a number of works that used the methodology. The following can be highlighted:

- lack of details about methodology for data collection;
- lack of details about use of additional data sources for triangulation and validation;
- lack of clear definition of original research aims;
- lack of definition about site choice.

[3] The concept of triangulation can be found in Triviños (1987). It is a technique related to the use and convergence of multiple data sources. It will be briefly discussed in Section 5.5.

2.2 - A scientific methodology for MIS case studies, proposed by Lee [4]

> *"The article's view of scientific method could help secure the emerging position of qualitative research in MIS and perhaps, at the same time, reconcile the perceived differences between quantitative and qualitative approaches in MIS research" (Lee, 1989).*

Lee (1989) presents a scientific methodology for conducting case studies in the Information Systems field. The article provides significant suggestions for researchers (in view of the current belief that research has to be mathematical, statistical and quantitative to be considered scientific) and users of this method (those who will be able to identify where scientific rigor can be applied).

Case studies concern the examination of the world as it is in its natural environment. Four problems can be detected in conducting these studies as applied in the Information Systems area:

(1) How to perform controlled observations: Typically, researchers observe the influence of one factor on another, isolating both from the influence of other factors that somehow might generate confusion. In laboratory experiments, control groups and experimental groups are used. In statistical experiments, statistical controls are used, such as multivariate regression analysis. Unfortunately, for researchers using case study, studying the real world in Information Systems in their natural setting excludes, laboratory controls and generates more variables than data, a situation that makes it difficult to apply statistical controls.

(2) How to make controlled deductions: Performing controlled or logical deductions with mathematical propositions is standard practice, accepted without controversy. In case studies, however, the researcher needs to manipulate qualitative data and verbally uttered propositions. Though it is possible to make controlled deductions with verbal propositions (qualitative analysis), it is problematic because we cannot be sure that deducted assertions are not incorrect?

(3) How to conduct research for replicability: Research in natural sciences is routinely replicated so as to ensure research objectivity. However, the researcher of Information Systems cases cannot observe the same events the same way more than once.

(4) How to conduct research for generalization: A desirable quality in theories is their applicability to a diversity of settings. A case study, however, is seen as characterized by a single, non-replicable event.

Lee (1989) presents, as an example of a scientific case study in Information Systems, the work performed by Markus (1983) entitled *"Power, Politics, and MIS Implementation"*. Markus presents three

[4] Lee, Allen *A Scientific Methodology for MIS Case Studies* MIS Quarterly, v. 13, n. 1, 1989.

alternative theories for the same theoretical basis. In addition, she compares the deductions of each against the observations made in the natural setting.

How did Markus deal with the four problems previously described?

(1) How to perform controlled observations: Markus solves the problem of how to perform controlled observations by using *natural control* (situations or events of the setting itself where research is taking place). In using natural controls and treatment, the researcher should do more than just wait passively for controls and treatment to materialize. He must be active in the sense of deriving predictions that take advantage of natural controls and treatments that have just occurred or seem to be about to occur. The researcher makes as many choices as the statistician in choosing his/her data.

(2) How to make controlled deductions: Mathematics is a subset of formal logic, not the opposite. Logical deductions, in general, do not need mathematics. A case study that makes its deductions with verbal propositions (qualitative analysis) is just deprived of the convenience of algebraic rules, but is not deprived of the rules of formal logic. The theory of evolution, for instance, is composed of words and sentences rather than numbers and mathematics.

(3) How to conduct research for replicability: One way is to apply the same theories tested in the original case study in a situation with different initial conditions. Even if observations of a particular case study are non-replicable, discoveries of a case study may be replicable.

(4) How to conduct research for generalization: By testing and confirming the theory in a variety of situations through comparisons with other case studies perfomed in other settings.

Lee (1989) claims that scientific methodology does not need to involve such elements as laboratory controls, statistical controls, mathematical propositions and replicable observations. Case study can achieve scientific aims by other means (natural control, verbal propositions, test of a new theory through new predictions, new observations rather than replication of the same). *Generalization* is the result of successive tests through a set of settings, not a single test in a single setting.

2.3 - A longitudinal field work: Barley [5]

> *"Although longitudinal field research seems particularly well suited for studies of the social ramifications of new technologies (...), like all research methods, mine suffer from biases and limitations that should be made explicit" (Barley, 1990).*

According to the author himself, it is a "confessional narrative", not exactly a case study. Longitudinal field research requires much discipline and awareness: there is a precarious balance between the controllable and the uncontrollable, the cognitive and the affective, the planned and the unexpected. The author began the project with some general issues and loosely articulated hypotheses.

The first great contribution is in the methodology suggested for data collection, carried out using three approaches: synchronic, diachronic and parallel.

- Synchronic Analysis: any social environment can be read as an historical document, momentarily caught between the past and the present. Differences and similarities can be highlighted between tasks, roles and relationships; and old and new technologies can be analyzed concurrently.
- Diachronic Analysis: while synchronic analysis is performed at a point in time and observes the environment as a whole (comparing some technologies with others), diachronic analysis examines the development of a specific item over time (contrasting recent and remote periods of technological use).
- Parallel Analysis: parallel studies in various environments can identify cultural and structural idiosyncrasies, as well as their common points.

At first glance, it may seem that synchronic, diachronic and parallel are synonymous with the terms cross-sectional, longitudinal and comparative; however, Barley (1990) points out differences. Synchronic analysis is especially useful to make statements that generalize across members of a class of events, objects, people or activities. Diachronic analysis is crucial to explain a typology of differences. Parallel studies permit generalizing synchronic and diachronic findings across similar environments.

As to the method, Barley worked for a year as a participating observer. If social rules are standards, and technique changes these standards; so investigation requires continuous observation, since the study of changes cannot be based only on interviews or filed material.

[5] BARLEY, S. *Images of Imaging: Notes on Doing Longitudinal Field Work* Organization Science, v. 1, n. 3, 1990, p. 220-242

It is worth recalling here that, as defined by Benbasat et al (1987), this research could be classified as action research, because the researcher participated in it. However, there was no intention of intervening, in the sense of acting on behalf of the organization, of changing or influencing some aspect of its operation. In any case, as case study, action research or participative research, interest in this experience lies in *description of data collection techniques and analysis of qualitative data*..

According to Barley (1990), the analysis of field data begins during the observational stage of the study. By using a comparative research project and stressing the systematization of observations, researchers can gather a body of notes ready to be systematically analysed. By analyzing notes from time to time during data collection, theoretical notions and hypotheses can be developed that guide data collection in an increasingly systematic way. Barley divided the process into four stages, described below:

- *Development of Categories*: Because of its richness, any set of notes can be analyzed from a variety of perspectives. However, the first step is to develop categories to classify data. An alternative is to build a typology of *episodes and procedures* (which tend to be repetitive). Others are *types of interaction* and *typical days.*
- *Sorting Data:* With a system of categories in mind, the researcher reads and *rereads* the whole body of notes, classifying and ordering them.
- *Identification of Patterns and Scripts*: After classifying notes and after organizing incidents within each category in chronological order, the next step is to scan data in search of patterns or scripts (recurring behaviors that define, in observable terms, the essence of roles and actions that characterize an interaction in particular).
- *Synchronic and Diachronic Comparison of Scripts:* The last step requires a quantitative section. For the synchronic analysis, the author combined each ocurrence of scripts through different technologies. The diachronic analysis was performed by combining each frequency of scripts during specific stages of each evolution of the same technology.

Indeed, Barley's second great contribution lies in this detailed, systematic method of qualitative data analysis.

2.4 - A dual methodology for case studies, proposed by Leonard-Barton [6]

> *"Because researchers have differing skills, it behooves us to consider the match between researchers and methodology" (Leonard-Barton, 1990).*

Leonard-Barton presents a dual methodology; that is, one that combines longitudinal case studies (a single site) with retrospective analyses of multiple case studies (several sites). He defines a case study as the history of a current or past phenomenon, delineated from multiple sources of evidence, which may include data from direct observation and systematic interviews, as well as from public and private files. Theoretically, every fact relevant to the set of events described in the phenomenon is potential data for a case study. The context is important.

A *single case* is subject to generalization limits and many potential deviations. *Multiple cases* increase external validity and help avoid such deviations. According to Yin (1984), the logic of multiple cases is similar to the one that guides multiple experiments. Each case can be selected so as to (1) predict similar results (literal replication) and (2) produce opposite results, with predictable reasons (theoretical replication). Nevertheless, Yin argues that the most significant limitation in retrospective analyses is the difficulty to determine causes and effects of reconstructed events. A longitudinal case study increases internal validity because it permits delimiting causes and effects.

The experience of Leonard-Barton with retrospective cases provides important contributions. In the first case, he applied a structured interview, first to a small number of interviewees (pilot study), and then to a larger number of them. This process provided a comprehensive survey of interviewees' opinions about the technology investigated (strengths and weaknesses, influences on adoption, etc.). Due to the high level of redundancy in responses, he saw the need to obtain data from multiple perspectives. Thus, in the following eight studies, he interviewed a smaller number of people chosen from among populations that were representative of multiple perpectives. Unstructured interviews and a short questionnaire were used.

Choice of cases was deliberately done by varying the context, for greater generalizability. Literal replication in multiple cases requires the phenomenon under investigation to be defined by some characteristics shared by all research situations. In this case, three criteria were adopted: (1) technologies developed internally, (2) for internal use, and (3) for the past five years. Theoretical replication means to explore cases

[6] LEONARD-BARTON, D.L. *A Dual Methodology for Case Studies: Synergistic Use of a Longitudinal Single Site With Replicated Multiples Sites* Organization Science, v. 1, n. 3, 1990, p. 248-266.

where the phenomenon to be proved may fail (that is, situations with opposite characteristics are pursued to produce opposite yet predictable results).

Concerning the longitudinal study, Leonard-Barton obtained data by structured and unstructured methods. Structured methods included telephone and mail surveys, questionnaires, filed data and interview sessions with developers. Unstructured methods included a collection of notes taken during meetings and non-structured interviews.

One of the major contributions of this work is to evidence a strong synergy resulting from the combination of longitudinal and cross-sectional methods, stressing two major groups of advantages: (1) particular gaps or weaknesses of a method are compensated by specific forces in the process of obtaining data of the other and (2) complementary approaches of each method increase three types of validity: external, internal, and construct.

- *External validity*: multiple cases clearly have more external validity than a single case; that is, they permit certain generalization.
- *Construct validity:* a construct is validated if predictions made based on the relationship of other variables are verified when tested. When multiple sources of evidence produce similar results, they are evidence of convergent validity of a construct. If the construct can be differentiated from other constructs, it also holds discriminating validity.
- *Internal Validity:* the exchange of ideas provided by the use of a dual methodology is useful for establishing internal validity, providing further evidence of hypotheses about causal relationships between variables.

However, Leonard-Barton also presents clearly the limitations of the methodology proposed; such as data *vulnerability* to be interpreted subjectively, and the difficulties faced by a single researcher compiling evidence about relationships among variables (limitations inherent in qualitative case studies). However, two problems more particularly associated with the dual methodology are: coordination of approaches to collection of different data and treatment of a large volume of data produced by combined approaches.

With regard to operational conditions, the main *difficulties* concern structuring collection of data, choosing the unit of analysis, and selection of cases. Yin (1984) argues that selection of each case must address specific aspects of theory improperly addressed by previous theories; that is, he suggests a sequential selection over the process.

3. A research project for application of case study?

> *"A certain configuration of intellectual technologies in a given moment opens certain fields of possibilities (rather than others) to a culture. What possibilities?" (Lévy, 1990).*

Our intention is to approach a research project in detail, so as to be able to check (later, in Section 4) the pertinence and adequacy of applying case study. The research project is entitled "*In search of a model of Enterprise Information System (EIS) that integrates elements that enable conditions for proactivity*" [7].

3.1 - Theme, justification and aims

The research theme is part of a comprehensive project that investigates the role played by information and decision support systems in decision makers' behavior. Its goal is to explore the characteristic of *proactivity* (or 'being proactive'). A number of dimensions are potentially involved, both in exploring proactivity and in undertaking the project as a whole. On the one hand, we have proactivity from the point of view of the system *designer*, of the analyst or information professional, that conceives, develops and implements Information Systems in order to provide support to the decision maker. On the other hand, there is proactivity from the point of view of the users, of those who use the system, who search for information. In this project, we attempted to explore conditions that enable decision makers to anticipate problems and to find opportunities as a result of better use of information, taking advantage of it, and winning competitive advantage.

Why is it important to search for a new model of information system? Because it attempts to identify better conditions for decision making in the 1990s scenario, characterized especially by factors such as : (1) economic globalization and greater interdependence among nations; (2) intense competitive environment; (3) marked shortening of product life cycle; (4) intensification of technological evolution impact; (5) organizational transformation and *paradigm shift* (Tapscott & Caston, 1995). The overall aim is to define a conceptual model of *Enterprise Information System (EIS)* that integrates elements that enable, besides reactivity, conditions for being proactive.

[7] This project is being elaborated and undertaken by GESID/PPGA (Management Graduate Program, UFRGS, Porto Alegre, Brazil), with the participation of Marlei Pozzebon and Maira Petrini under supervision of Professor Henrique Freitas.

Among specific aims, we stress: (1) identify and classify different types of data and information that must be considered or assimilated by *Enterprise Information Systems*; (2) identify elements of MIS (Marketing Information Systems, Kotler, 1994) and other Information Systems that constitute a potential contribution to model conception; (3) explore the concepts of *proactivity* and *reactivity*.

3.2 -Methodology

When the researcher defines his/her investigation plan or research scheme, he/she may choose from three types of study, whose purposes are different (Gil, 1994): exploratory studies, descriptive studies, in which researchers do not intend to establish theories but to present what is believed to be objective and factual, and explanatory studies, in which researchers aim to test a theory and its causal relationships. Exploratory studies enable the researcher to increase his/her experience about a given problem (Grawitz, 1976). The researcher starts from a hypothesis or from an idea and "deepens his/her study within the limits of a specific reality, searching for antecedents, greater knowledge so that he/she can then plan descriptive or experimental research" (Triviños,1987, p.109).

The present research project is of an *exploratory* nature, inasmuch as it stands as a first attempt to integrate some emerging issues in literature concerning information and decision support systems. These are emerging issues that permit raising a number of concepts, models, characteristics and tendencies – which we shall call *emerging elements* – related to Information Systems that appear in literature in a disconnected and scattered way.

Though it may seem simple, undertaking an exploratory study requires the careful scientific treatment characterizing any research work. "This type of investigation, for instance, should not fail to include literature review, interviews, use of questionnaires, etc., all as part of a scheme elaborated with the severity characterizing a scientific work" (Triviños, 1987, p.109). Figure 1 shows a schematic design of the method to be used in this research work.

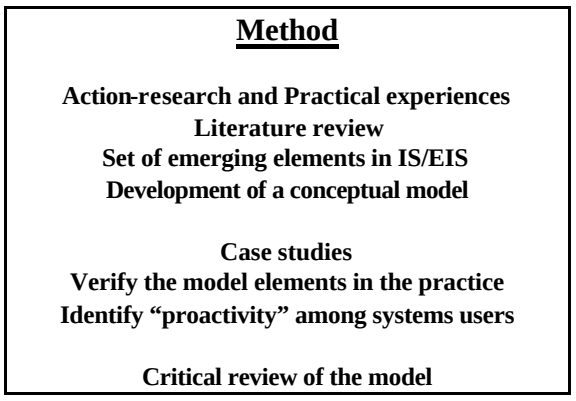

Figure 1 - Method Design

(1) Action Research: Two practical experiences, which occurred in Brazilian companies between 1994 and 1996, were characterized as action research because essential elements of such methodology were present in both: (1) planned action by researcher, (2) such action followed a method for its development, and (3) there was a report of difficulties faced, conclusions, and recommendations (POZZEBON & FREITAS, 1996).

(2) Definition of a Set of Emerging Elements in IS/EIS: literature review and experience and results obtained from works characterized as action-research, performed between 1994 and 1996, permit an initial mapping of what we call *emerging elements.*

(3) ***Development of a Conceptual Model of EIS*** *- Enterprise Information System - that integrates elements found in literature review and in action-research works.*

It is important to clarify the idea of *conceptual model* we are using here. According to a definition by Alter (1992), a model is a useful representation of a thing. Models highlight some aspects of reality and ignore others. An information system is a model, or even a set of models. For Sprague & Watson (1991), any model is descriptive if it is a valid representation of reality. In IS, a descriptive model describes the system's behavior.

Concepts allow researchers to classify their experiences and generalize them to others. That is, scientists structure, categorize, order, and generalize their experiences and observations in terms of *concepts.* To organize *concepts*, theoreticians often use *models*. A *model* is a representation of reality; it delineates those aspects of the actual world that the scientist sees as relevant to the problem investigated. It clarifies the significant relationships among these aspects, and it enables the researcher to formulate empirically tested propositions in view of the nature of such relationships. After testing it, and achieving a better understanding of any portion of the actual world, the scientist can decide to change the model in order to adapt it to new ideas (Frankfort-Nachmias & Nachmias, 1996).

What we have attempted to build is a *conceptual model* of an information system; that is, a generic, abstract model that proposes elements and shows relationships among them that relate the type of data or information (content) to the strategy of access to them (means). This *conceptual model* will establish a range of possibilities for the relationship between users and data or information. The expected result is the proposition of a model that can be applied to EIS projects and serve as a basis for the next stages of the global project.

Nevertheless, a critical review of the model seems to be necessary after its initial elaboration. This critical review should be based on reality, on what is being experienced in companies in terms of relationship between technique and use; that is, the EIS in operation and its users (decision makers). Accordingly, we have developed the following research design: (1) conception of a model; (2) selection of issues derived from model for empirical investigation; (3) design of a research project to verify issues. If issues are not supported by empirical data, changes must be made to the model – critical review – or to the research project and return to phase 2. If issues are evidenced, the model must be optimized and go on to the next stages of the project.

Since the critical review of the proposed model will be performed through case studies, in the next sections, we intend to discuss the applicability of this method to the project reported above.

4. Why can case study be applied in this research?

> *"Generation of any scientific knowledge depends largely on the techniques for data collection, analysis and interpretation and on the way they are applied" (Pinsonneault & Kraemer, 1993).*

Why can the case study method be considered more suitable to collect elements that enable a critical review of the model conceived? Our goal is to identify elements, both from the model proposed (EISs in use in companies) and from *proactive* postures (systems' users). Based on the authors' assertions (•) analysed in previous sections, we shall verify the adequacy of case study (⇒).

The major reasons justifying a case study, according to Benbasat et al (1987), can be verified in this research context:

- Answer questions of the "why" and "how" type, allowing the understanding of the complexity of the process.

⇒ "What are the elements of EISs in use in companies, and how are they integrated?"

- Study information systems in their natural environment.

⇒ Study what EIS models are present in companies, confronting them with the proposed model.

- Investigate an area in which few previous studies have been carried out.

⇒ The concept of proactivity relative to use of EIS is an emerging concept in IS.

In addition to these, other statements can be made, as stated by Yin (1984):

- The researcher has little or no control over events.

⇒ In this case, there is no control; model is not applied; there occurs only observation.

- Focus is a contemporary phenomenon within the context of real life.

⇒ It is the use of EISs by users within their action context.

It is also interesting to confront the nature of this work plan with the categorization elaborated by Benbasat et al (1987) in terms of qualitative research. Among description of application, action-research and case study, this research can be classified as case study because:

⇒ A research study will be conducted, rather than an implementation (description of application).

⇒ No intervention will be performed (action research).

⇒ Researcher will conduct research only as investigator or observer, not as participant (case study).

Also based on Benbasat, Goldstein and Mead (1987), let us answer the four questions suggested to evaluate the actual usefulness and adequacy of using case study in research:

- Can the phenomenon of interest be studied out of its natural environment?

⇒ No, as our aim is to explore elements from the EIS effectively implemented in companies and identify proactivity signals in the use of such systems. We can achieve such goals only by exploring and observing directly the companies' environments.

- Does the study focus on contemporary events?

⇒ Yes, because our aim is to observe systems and users' behavior today, with current technology.

- Is control or manipulation of individuals or events necessary?

⇒ No, because our objective is only to identify technical and behavioral elements, without any causal relationship between variables. The effects of the model on behavior, that is, the finding that a particular model actually contributes to proactivity, will be the object of the next stages of the global project in which this research is included.

- Does the phenomenon of interest have any established theoretical basis?

⇒ No, literature review has brought to the fore a series of elements that signal the emergence of the proactivity concept, but such elements appear in a disconnected way.

5. Planning the application of case study (observing a "certain" methodological rigor)

We believe case study is the proper methodology to review critically the developing conceptual model of EIS. However, timely choice of a research method does not ensure successful results. Care should be taken so that each step is taken the best way possible; that is, with as much scientific rigor as possible. The major steps to be followed in our research are presented below, as well as care to be given and recommendations found in a review of the literature.

5.1 - Unit of analysis definition

According to Benbasat, Goldstein and Mead (1987), careful examination of research questions allows defining the unit of analysis. The two main stages of the research development are characterized by development of a conceptual model and critical review of such model. There is no research question related to the development of the conceptual model. However, for the critical review of the model, two research questions are raised: ***What are the elements of the model -- or absent from the model -- that can be identified in EISs present in companies? Are there signals of proactivity in these systems' users? What are they?*** This stage of the work attempts to confront the conceived model with models already implemented in companies. The purpose is to check whether emerging issues in the literature are already reflected in company practices, whether emerging elements integrated in the proposed model can actually be found in EISs used in companies, or if there are other elements not yet considered or predicted in this work. That is, the focus is primarily on the system.

Simultaneously, using the concepts and characterization defined over the literature review on proactivity, an attempt will be made to identify (perhaps in an incipient way) proactive behaviors in the users of the information systems identified. We shall try to identify signals that characterize either reactive behaviors -- those which solve problems and *extinguish fires* -- or proactive behaviors -- those which anticipate problems and identify opportunities. Here, the focus is not the system, but users' behavior relative to the way they use the system. Clues, initial inferences indicating the presence of proactivity, will be sought to be used as a basis for the next stages of the project. That is, revisit the system model, again.

For these reasons, we consider that the *unit of analysis* must be the *system*. Systems' users will be only the respondents and will correspond to one of the data collection strategies.

5.2 - Defining research type

With regard to the number of moments when data are collected, research can be (Sampieri et al., 1991):

- *Longitudinal*: Data collection occurs over time, in specified periods or points, trying to study the progress or changes of certain variables or even the relationships between them.
- *Cross-sectional*: Data collection takes place only once, trying to describe and analyze the state of one or more variables in a given moment.

With regard to the number of moments when data are collected, this research will be of the *cross-sectional* type. Data collection will be performed only once because we are not interested in the evolution of EISs over time, but in a picture of the models used at present.

5.3 - Defining number of cases

We intend to perform four case studies; that is, we have chosen multiple cases rather than a single case. Our choice is based on the considerations below.

According to Yin (1984), a single case (•) is suited for some situations that, from our point of view, does not correspond to our research (⇒):

- It is a critical case to test a well formulated theory.

⇒ It is not a critical case.

- It is an extreme or unique case.

⇒ There is no indication that this is the situation; even though no system with a similar model to the one conceived in the research is identified. A critical review will be performed in the diversity of the four cases.

- It is a revealing case.

⇒ There is no indication that this is the situation; even if some company reveals a totally innovative or surprising model, only the observation of a number of system models can contribute to a critical review.

The adoption of multiple cases is useful to describe a phenomenon, to build a theory, or to test a theory. To build a theory is the intent of this research: to propose an EIS model that will actually contribute to users' proactivity. Furthermore, a multiple case project can be considered analogous to the replication performed with traditional multiple experiments, permitting greater power of generalization.

5.4 - Selection of sites

The criterion for company selection is founded on the elaboration of an *analysis grid* that allows the identification of elements existing systems have in common with the proposed model. Proposed stages for company selection are the following: (1) To identify, by telephone consultation, companies that possess EISs in full operation. The criteria will be, time since the system was implemented, and number of users. We will consider that a system in use for at least a year and also having at least ten users is a system in full operation. Ten companies will then be selected that meet the criterion "possess EIS in full operation"; (2) To elaborate an analysis grid that permits the identification of the elements of the proposed model; (3) To contact people in companies (visit or telephone), in order to fill the analysis grid, trying to find out what elements of the model are present in their EISs. The total number of elements in each company will be used in the next stage; (4) To arrange companies according to number of elements in their EIS in common with elements of the proposed model. Such classification will enable us to select two companies that possess a great number of elements of the model and two companies that possess a small number of elements of the model.

By analyzing both criteria suggested by Yin (1984) for *site selection*, we can make the following recommendations:

- Sites where similar results are predicted can be used as literal replications;

⇒ Literal replication can be sought in companies that possess very similar EIS models or models with a large number of elements and characteristics in common.

- When contradictory results can be predicted, they can be used as theoretical replications;

⇒ Theoretical replication can be sought in companies that possess EIS models that are very different or with few elements or characteristics in common.

In view of the fact that the main goal of the research is to conceive and critically review a system model, characteristics of the systems will be given consideration as major criteria for site selection: (1) to possess EISs in full operation based on the number of users and time in operation, and (2) number of elements in common with the proposed model.

5.5 - Defining data collection methods

We cannot assert that the tools used for data collection in qualitative research are different from those used in quantitative research. "In fact, questionnaires, interviews, etc., are *neutral* means that acquire definite shape when the researcher illuminates them with a given theory" (Triviños, 1987, p.137). However, it could be stated that semi-structured interview, open or free interview, open questionnaire, free observation, and content analysis are the most crucial tools for studying processes and products in which the qualitative investigator is interested.

The multiplicity of resources of which the qualitative researchers may make use while conducting our studies – trying to achieve maximum comprehensiveness in describing, explaining, and understanding what is in focus – allows us to bring the technique of *triangulation* to the fore (Triviños, 1987). This technique enables us to focus our attention on the processes and products centered around the individual investigating individuals' perceptions, through interviews and questionnaires, and individual's behaviors and actions, through free observation. We also focus our attention on elements generated by means of the individual (documents, system specifications, projects, etc.), and on processes and products derived from the socio-economic context.

In order to have good coverage of aims of the research and to search for evidence from multiple sources to support the findings of the exploratory research, multiple methods for data collection will be used. Tools used for data collection will be: detailed filling of analysis grid, documents analysis, direct observation, and semi-structured interviews.

5.6 - Protocol for undertaking case studies

Elaborating a protocol is a strategy to be followed to increase the reliability of case study method of research. It should include the tool, procedures and general rules to be followed in using the tool (Oliveira, 1996). The first activity in companies will be to review the analysis grid used in the company selection stage. However, at this moment, the analysis grid will be filled out in detail, using system specification documents as a basis, as well as an interview with the professional responsible for it.

Direct observation of the system in operation, together with collected data, will enable the researcher to have a relatively thorough knowledge of the EIS in use and to assess the similarity of such system to the proposed model. Afterwards, interviews with each system's users should be started. Semi-structured interviews "value the presence of the researcher, offer all perspectives possible for the interviewee to feel free

and be spontaneous, enriching the investigation" (Triviños, 1987, p.146).

The aim is to interview as many EIS users as possible in each company (preferably people from diverse departments and hierarchical levels). The interview proper is still at an early elaboration stage and still depends on the definition of some issues concerning methodology and the concept of proactivity.

5.7 - Data analysis

The data analysis stage will certainly depend on the researcher's power to integrate the different data collected. The major aim is to critically review the model. With data collected through semi-structured interviews, document analysis, and observation, data analysis is expected to be organized as shown in the reference chart (Figure 2).

The ideal would be to achieve all four situations mapped in the Reference Chart; that is, to carry out a critical review obtaining data for reviews of types 1, 2, 3, and 4 pointed out in Figure 2. However, such condition is not indispensable, since it is an exploratory study. The aim is to critically review the model proposed and make some initial inferences concerning the concept of proactivity that can be used as a basis for the next stages of the project.

Through the criterion used for company selection, we will attempt to ensure data collection in two companies having systems with many (or all) elements of the proposed model, and two companies with few (or no) elements from the proposed model. However, we cannot be sure that there will be users fitting in both situations concerning the proactivity concept. Thus, we will certainly carry out reviews of type 1 or 2 and reviews of type 3 or 4. In each of them, one has the opportunity to review critically the model initially proposed.

	There are many characteristics or signals of proactive user	**There are few characteristics or signals of proactivity (or there are none) - user**
There are many or all elements of proposed model system	Review Type 1: Reinforce elements, add elements, review elements, etc.	Review Type 2: Question elements; exclude elements; etc.
There are few or none elements of proposed model system	Review Type 3: Suggest elements; add elements...	Review Type 4: To give value to the model...

Figure 2 - Reference Chart for Critical Review

5.8 - Reporting results and searching for scientific rigor

The results of these case studies will generate four reports, where the context and collected data will be presented in detail. Data analysis will enable the critical review of the conceptual model.

Lee's description of case study as a scientific method presents a series of recommendations and care that, if followed, provide research with more (or less) methodological rigor. Below, we try to assess possible strengths and weaknesses of our research relative to the methodological rigor pointed out by Lee.

(1) *How to perform controlled observations:* Because studies in natural environments exclude laboratory controls, natural controls will be sought. It means that choices should be made, during our stay in companies, about which data to collect, what moments or situation to analyze, what people to interview, etc.

(2) *How to perform controlled deductions:* Since logical deductions can be obtained through verbal propositions, we shall try to establish, mainly through semi-structured interviews, relationships between system models and users' behavior. Such deductions will be tested later [8].

(3) *How to conduct experiments for replicability:* Carrying out four case studies, in sites chosen according to criteria defined, will contribute to two types of replication: literal and theoretical.

(4) *How to conduct experiments for generalizability?* Carrying out four case studies, in sites with common elements but diverse contexts, will contribute to a greater generalizability of results.

As to methodology proposed by Barley (1990), classifying data collection and analysis under three approaches (synchronic, diachronic, and parallel), our research can use the parallel approach only, due to the nature of the research issue. A synchronic focus would require concurrent analysis of use and non-use of the system, while the diachronic approach would require analyzing system use over a long period of time.

A distinction should be made here between the concept of synchronic analysis and *cross-sectional* research. According to Barley's categorization (1990), since we shall perform parallel studies in a number of settings to determine unique and common points, we shall be working with the parallel approach only. However, according to Yin's definition (1984), we will be undertaking a *cross-sectional* study. In this case, it does not correpsond to Barley's synchronic analysis.

[8] Through the construction of a prototype based on the conceptual model proposed, the second part of the present project has the purpose of testing the effect of the system on users' behavior.

Finally, reconsidering considerations by Leonard-Barton (1990), the impossibility of adopting a dual methodology leads us to a greater attention to considerations made on retrospective cases; in fact, we shall lead data collection to the search of multiple perspectives and select case sites according to criteria related to common characteristics.

6. Conclusions

This article explores the potentialities of the case study method in view of the experience of several authors who reported their difficulties, successes, and recommendations. Our purpose was to determine a series of guidelines to be followed, step by step, in applying case study with some scientific rigor. It is a type of schedule that we shall follow in developing our present research work and that, we believe, may be useful to other researchers intending to use such methodology in their work.

In light of all recommendations mentioned, we firmly believe that we will have better conditions to pursue the aim of our research: a conceptual model of an *Enterprise Information System (EIS*) that enables conditions for proactivity. Enabling conditions does not mean ensure the presence of proactivity. Systems can facilitate, conduct or even interdict; but they cannot determine anything. What is of interest are the opportunities that may exist and may emerge from the case studies we intend to perform.

This initial effort to review bibliography on case study and systematize the main conditions that may ascribe more scientific rigor to their application can be appreciated in two ways. First, as the strategy chosen to guide our project, because we believe that studying and applying the steps and recommendations mentioned in this article will enable us to achieve our aims with a greater scientific rigor. Second, it may be useful to other researchers, who may use this material as a starting point to evaluate what greater rigor is all about.

References

ALTER, S. *Information Systems: a Management Perspective.* New York, Addison Wesley, 1992

BARLEY, S. *Images of Imaging: Notes on Doing Longitudinal Field Work.* Organization Science, v. 1, n. 3, 1990, p.220-242

BENBASAT, I.; GOLDSTEIN, D., and MEAD, M. *The Case Research Strategy in Studies of Information Systems.* MIS Quarterly, v. 11, n. 3, 1987, p.369-387

FRANKFORT-NACHMIAS, C., and NACHMIAS, D. *Research Methods in the Social Sciences.* Londres: Arnold, 1996

GIL, A.C. *Métodos e Técnicas de Pesquisa Social.* São Paulo, Brazil, Atlas, 1994 (Methods and techniques in social research)

GRAWITZ, M. *Méthodologie des Sciences Sociales.* Paris: Dalloz, 1976

KOTLER, P. *Marketing Management: analysis, planning, implementation, and control.* Englewood Cliffs, New Jersey: Prentice-Hall Inc.,1994

LEE, A.S. *A Scientific Methodology for MIS Case Studies.* MIS Quarterly, v. 13, n. 1, 1989

LEONARD-BARTON, D.L. *A Dual Methodology for Case Studies: Synergistic Use of a Longitudinal Single Site With Replicated Multiples Sites.* Organization Science, v. 1, n. 3, 1990, p.248-266

LÉVY, P. *Les technologies de L'Intelligence.* Paris, Éditions La Découverte, 1990

MARKUS, M.L. *Power, Politics and MIS Implementation.* Communications of the ACM, v. 26, n. 6, 1983, p. 430-444

OLIVEIRA, M. *Proposta de Tese de Doutorado - Indicadores para Construção Civil.* Porto Alegre, Brazil: PPGA/UFRGS,1996 (building quality indicators)

PINSONNEAULT, A. and KRAEMER, K. *Survey Research in Management Information Systems: An Assessement.* Journal Of Management Information Systems, Fall 1993

POZZEBON, M. and FREITAS, H. *Construindo um EIS (Enterprise Information System) da (e para a) Empresa.* RAUSP - Revista de Administração da USP, São Paulo-Brazil, v. 31, n. 4, Oct. 1996, p.19-30 (toward an EIS from - and to - the organization)

SAGAN, C. *The demon-haunted world: science as a candle in the dark.* Randon House, 1996

SAMPIERI, R. H. et al. *Metodología de la investigación.* México: McGraw-Hill, 1991

SPRAGUE, R.H. and WATSON, H.J. *Decision Support for Management.* Prentice Hall, 1991

TAPSCOTT, D. and CASTON, A. *Paradigm Shift: The New Promise of Information Technology.* McGraw-Hill Inc, 1993

THIOLLENT, J. *Metodologia da Pesquisa-ação.* São Paulo, Brazil, Atlas, 1992 (Action-research methodology)

TRIVIÑOS, A.N.S. *Introdução à Pesquisa em Ciências Sociais.* São Paulo-Brazil: Atlas, 1987 (Introduction to social sciences research)

YIN, R.K. *Case Study Research, Design and Methods.* California: Sage Publications, 1984