The Development of a Case Study Methodology in the Information Technology (IT) Field: A Step by Step Approach

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An important step any researcher should take is establishing a framework in which to conduct the research.

This paper helps with the setup of a case study methodology by explaining the different phases that could be followed. It explains different research options and helps with the motivation for a case study approach. This step is difficult because there are quite a number of options available and established researchers often argue for their own research. This article will discuss the case study and grounded theory approach that can be used to investigate IT in South Africa and elsewhere.

An Overview of the Study

This paper discusses case study methodology and the philosophies that underpin research. It seems that a majority of research projects rely on a number of data collection methods. It should also be remembered that people do what they know, do what they have done, do what is easier and do what is rewarded. It is thus important to explore new avenues by expanding the definition of data and thereby creating opportunities for discoveries.

Focus on Key Concepts

The focus of any research project should first be on the development of a research culture. Engagement in research is critical for developing excellence in teaching and expertise. This is because through research it is possible to encounter uncertainty and through uncertainties the potential to develop. The importance of qualitative data and the construction of narratives as a key procedure in the development of theoretical conjectures and empirical generalisations or hypotheses are also emphasised. Remenyi & Williams (1995) put the importance of paradigmatic thinking and research into perspective by contrasting the paradigmatic approach with narrative thinking and qualitative research.

Although the author advocates the importance of qualitative research in IT, it also recognises the distinguishing feature of modern science as the formulation of laws that capture the essential features of a problem and allows predictions into the future and about different situations.

Aim of Research

Any research should be aimed at realising a goal and it should be covered in such a way that it must be clear to the readers of the research that the designer of the research knows what he was aiming for. The aim of the research could be:

* To study and evaluate the approach to the problem that will be researched;

* To develop a preliminary theory of good practice to solve the problem;

* To test this theory by reference to other enterprises and practitioners; and

* Thereby develop the theory into managerial guidelines.

Why Research Study is Important

Although evaluation has only recently become an important issue, interest in the IT research area has grown over the last couple of years. It is clear from previous research (Butler-Cox Foundation: 1990; Barua et al.: 1991) that many organisations are concerned with research issues because they are requested by CIOs to use resources effectively. This is also in keeping with a general need to become more competitive (Daniels & Daniels: 1993; Daniels: 1994). Thus, more organisations will attempt to establish, formulate and implement an approach that will meet their needs for efficiency and effectiveness (Earl: 1992; Farbey et al.: 1992, 1993).

Much of the available literature and the research focus on a calculation of the problem without commenting, or providing guidelines for managers who wish to address the problem in such a way that would best fit into their present system. It is, of course, not easy to identify factors that will support organisational strategies and to establish a method as to how organisations can do this will be of practical value to managers. Similarly, the selection of these factors requires detailed attention and advice as to how managers could apply them. Conducting research into practical issues, as the eventual effect on organisational performance, can be regarded as an issue that demands attention.

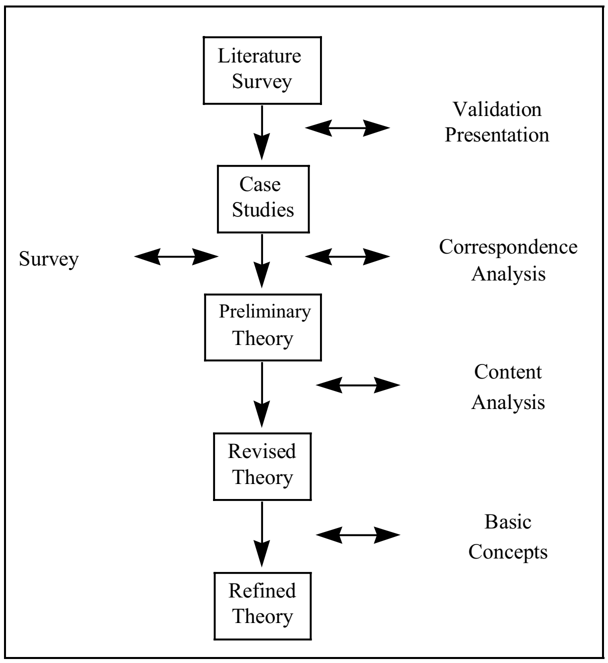
Initial Stages of Research

The theoretical and philosophical basis of any study is empirical research. The research strategy that could be employed was based on the approach described by Remenyi and Williams and illustrated in Figure 1. A literature survey of issues to be researched should be completed in stages. After the preliminary phase the literature review should be recorded because this becomes the basis of the research proposal that should be validated by presentation to a research committee and accepted. Subsequently the literature review can be extended, a critique developed and research questions established.

If there is no appropriate grand theory from which to derive hypotheses it can be decided to use a grounded theory approach and to collect evidence through the use of case studies. Thus case studies could be used to develop a theoretical conjecture concerning the formulation, adaptation and implementation of IT and its benefits. Case studies can be used if the focus of the study is to understand the how and why of a phenomena of IT within the organisational context. The evidence collected through the empirical case study normally result in a large transcript that could be analysed using both content and correspondence analysis and thus developed into a grounded theoretical conjecture.

A focus group can thus confirm that the theory was relevant and practical. A second level of validation could be undertaken by presenting the theory to several senior executives from leading organisations. These executives should be asked to confirm whether they could make use of the theory (action research). The research can thus employ a combination of qualitative and quantitative methodologies in order to ensure that it complied with scientific principles.

Figure 1: Derived from the research process (Remenyi & Williams (1993))



In summary the research project could consist of three phases: case studies, a focus group, and presentation of the results to practitioners for cross validation purposes. It is believed that several case studies are sufficient to establish a useful theory. The second phase of the study, using the focus group, should be done to comply with the principle of falsifying where an attempt is made to disprove the theory deduced from the case study work.

Research Options

The researcher could decide to employ empirical research in the study because it would enable him or her to get close to the organisation, gaining insight into the situations that exist around IT. Empirical research also helps the study to consider the meaning of certain more or less naturally occurring phenomena in the world of IT (Easterby-Smith et al: 1993). On the other hand, research also has a theoretical underpinning obtained from the literature review. The theory produced could be the result of reflections on the ideas supplied by individuals consulted during the tenure of the research.

Bias in Research

On the issue of bias, it is naive to assert that any form of research, or perhaps human activity generally, is without bias. Even in the physical and life sciences, bias is reflected in the subject researched, the experiments chosen, as well as the way the experiment is conducted. Thus bias cannot be totally eliminated but should be recognised and its implications acknowledged and accepted (i.e. lived with). Subconscience bias on the part of the researcher is a problem. Of course triangulation may be used to help in this respect, but in the final analysis an argument based on a judgement is always required in research (Collins 1994). This may not be easy to make with personal prejudices playing an overtly influential and important role. The bias problem was described by Hubbard (1979) when she said:

> "The mythology of science asserts that with many different scientists all asking their own questions and evaluating the answers independently, whatever personal bias creeps into their individual answers is cancelled out when the large picture is put together. This might conceivably be so if scientists were women and men from all sorts of different cultural and social backgrounds who came to science with very different ideologies and interests. But since, in fact, they have been predominantly university-trained white males from privileged social backgrounds, the bias has been narrow and the product often reveals more about the investigator than about the subject being researched."

With regards to research findings, it is important that these are honestly presented and not produced in such a way as to simply support the opinions or prejudices of the researcher. This is indeed hard to accomplish. Ideally the researcher is trying to apply "disinterested intellectual curiosity" (Trevelyan: 1942), but this is almost always impossible as was pointed out by Gould (1980) when he said: "Science is not an objective, truth-directed machine, but a quintessentially human activity, affected by passion, hopes, and cultural biases. Cultural traditions of thought strongly influence scientific theories."

Sometimes, if not frequently, personal bias is so subtle that the researcher is not even aware of it. In fact many would argue that a researcher should not attempt to compensate for this bias, but should simply state clearly the possible biases involved and allow the readers to compensate for these themselves.

Case Studies as Research Strategy

The case study methodology's approach is about gathering data with which to develop grounded theory. It can be selected for several reasons. These reasons will become clear from the description below of the case studies methodology. The way to handle case studies is similar to the way business issues are mostly handled. Classroom and syndicate groups provide the simulated business meetings in which the participant can learn both the skills of listening and presenting a point of view. The environment in which the case study is used helps participants to develop a degree of confidence in their judgement, as well as a degree of humility (Edge & Coleman: 1986).

Definition of a Case Study used as a Research Methodology

As a research strategy the case study research method is a technique for answering who, why and how questions. The use of multiple evidence allows the researcher to provide a convincing argument as an answer to the questions. It is not essential to the validity of the case study research method that a case study should be able to be generalised. In this type of research, generalisation is not a central issue. The relevance of a case study is more important than its ability to be generalised. When a case study is carried out both systematically and critically and aimed at the improvement of understanding then it is relevant, and if any publication of its findings extends or expands the boundaries of existing knowledge of the subject area, then it is a valid form of research. As the case study methodology can produce excellent results in the hands of a skilled investigator, its use is on the increase in most areas of the social sciences and certainly in information research.

Stake (1994) identifies three types of studies using the case study method. In the first type, he identifies intrinsic case studies in which the study is undertaken because the researcher wants a better understanding of the particular case. Using the instrumental case study as the second example, a particular instance is examined to provide insight into an issue or refinement of theory. In the third example he uses the term collective case study. In these, researchers may jointly study a number of case studies in order to inquire into the phenomenon, population, or general condition. The advantage of it is that case studies are frequently discussed and analysed, and subsequently courses of action are agreed upon in groups.

From a research strategy point of view, the case study methodology is a way of establishing valid and reliable information or findings which add to the accumulated knowledge of the processes by which business and many other organisations functions. It is a research strategy for the social scientist in the same sense as experiments are a research strategy for the natural scientist. Yin (1994) defines a case study as " … an empirical inquiry that investigates a contemporary phenomenon within its real life context, when the boundaries between phenomenon and the context are not clearly evident, and in which the multiple source of evidence are used. It is particularly valuable in answering who, why and how questions in management research."

According to Bell (1987), the case study methodology has also been described as an umbrella term for a group of research methods that have in common the decision to focus an inquiry around a specific instance or event. The philosophy behind the case study is that sometimes just by looking carefully at a practical, real-life instance, a full picture can be obtained of the actual interaction of variables or events. The case study allows the investigator to concentrate on specific instances in an attempt to identify interactive processes that may be crucial but that are transparent to the large-scale survey. Thus, the aim of the case study is to provide a three-dimensional picture of the situation. It should illustrate relationships, corporate-political issues and patterns of influence within a particular context.

Case studies are used to a larger extent by social science as both a research and a teaching vehicle, especially in IS (information systems) research (Lee: 1989). The scope of the case study is extensive, ranging from individuals, to organisational groups, to national policies or events. Cases are either persistent original (Stake: 1994), or one-of-a-kind situations. Cases are compared and their characteristics are studied and behaviour patterns noted. It is important to bear in mind that most cases are aggregates of complex behaviour (Stake: 1994).

From a research point of view, the case study methodology describes the total situation as a combination of different factors. The case study may focus on the description of the process or sequence of events in which the behaviour occurs, the study of individual or group behaviour in its total social setting, and the comparison of cases leading to the formulation or confirmation of hypotheses as claimed by Stake (1994). By means of the case study method it is possible to establish the number and variety of properties, qualities and habits combined in a particular instance. The depth of the inquiry possible through the case study method is greater than any other research method such as a survey (Galliers: 1991).

For example, although attempts are made to ascertain attitudes by means of questionnaires, the results are sometimes unsatisfactory, as one cannot do justice to an attitude by ticking yes or no, or rating 1 to 5. The case study can go much further than this superficial analysis and can discuss greater variations and reasons for attitudes (e.g., if a respondent is asked to rate a service rendered in a case study context, he or she may reply with both a score on a preset scale and a list of explanations and/or caveats qualifying the score). Additional information is beneficial to the researcher who may use it either as explanatory notes to the findings produced from the questionnaire or as raw material for content analysis.

Because the case study follows the logic of the experiment rather than logic of the survey, it is not necessary to repeat a case study (Yin: 1994). This is because the experiment starts with the formulation of a theory and then attempts to find evidence that will either support or disprove the theory while the survey attempts to get a general view of something. The experimental approach is used in the case study method of research. The reason why it is not necessary to repeat the experiment or case study many times, as is achieved with a survey, is the same as why it is not necessary to experiment with the boiling point of water many times to support or contradict the theory of transformation of liquids into gasses at a certain temperature. However, it is important to bear in mind that the case study methodology is not designed to measure the frequency of occurrence of events but rather to support or reject theoretical propositions.

Different Types of Evidence on Which a Case Study may be Based

From a case study research strategy point of view, the case study methodology implies comprehensive and intensive study of the subject. Thoroughness is thus one of the first pre-requisites. Facts must be ascertained from the enterprises or enterprises under study and then carefully interpreted. These may be obtained from documents, archives, and interviews with any person who has knowledge of the subject, observations of the investigator, participant-observer interaction, as well as physical artifacts. This information must be weighed, tested and sifted to eliminate fictitious and false statements as well as, where possible, personal opinions.

Bias in the Case Study

Case studies can rarely be objectively completed due to the bias of both the supplier and the recipient of the information. Stake (1994) regards this area of research as fraught with danger, primarily due to the problem of subjectivity interpreting data after it has been written down. Bias is everywhere, but can be minimised. It is the primary function of the researcher to minimise the bias level in which he or she is working.

There are at least three obstacles in obtaining unbiased testimonials from observers:

* The difficulties encountered by individuals in being able to accurately remember.

* The inhibitions individuals have in disclosing important feelings.

* The suspicion individuals have about revealing information that might reflect poorly on them or their superiors.

However, the use of multiple sources of evidence can help substantially in improving the validity and reliability of the research. By studying every aspect of the problem from as many angles as possible, and by using various sources of evidence, the case study research strategy is a powerful research tool in the hands of a skilled investigator (Stake: 1994).

The Significance of Uniformity when Recording Data

In multiple case study research uniformity of recording should be sought as it facilitates comparison between enterprises and situations which allows similarities and differences to be highlighted. Unless there is some uniformity, it can be extremely difficult to recognise similarities and much of the usefulness of the case study method may be eliminated. The methodology presumes a well-defined problem with a clearly articulated hypothesis. This is part of case study design and it is necessary to have this aspect of the research in place before an attempt is made to collect evidence or perform analysis.

The Formality of the Case Study Research Methodology

The case study research methodology is often mistakenly thought to be rather informal (Stake: 1994). This is because it is confused with case writing from a teaching-learning point of view. In fact, the case study research strategy methodology requires a distinctly formal structured approach. Before the interviewees can be approached, protocols must be drawn up. The protocol is a detailed master plan for the research. It is a document in which full details of the case study research design, including details of the questions to be asked, field procedures for the researcher, details of all types of evidence required, as well as the structure of the final research must be specified.

The Case Study Protocol: Research Objectives and Schedules

The case study protocol is both the instrument with which the case study is conducted, as well as the general rules and procedures with which the work is carried out. The overview includes the objectives or issues on which the case study investigator should focus. Figure 2 displays the overview, as well as an interview schedule that can be used to collect data during unstructured case study interviews. The investigator has to work in the real world and thus cope with real world situations during the data collection plan, including the possibility of the respondent dropping out of the experiment or case study. Similarly, corporate documents may not always be available.

Field procedures need to emphasize issues such as:

* Defining who should be interviewed;

* Gaining access to the right people;

* Having adequate resources available such as time, paper, tape records, etc.;

* Developing a procedure for discussing the research with other researchers; and

* Making a schedule of the required data collection activities providing contingencies.

A protocol is a primary tactic in increasing the reliability of the case study procedure and could have the following sections.

Figure 2: Example of Research objectives and interview schedules

Objectives of the research

The main objective of the case study research is to obtain evidence as to how firms formulate and implement IT and how to link IT to organisational performance. This will be achieved by using a series of unstructured interviews which will allow informants the opportunity of supplying information on a wide range of issues related to information, decision making, and implementation activities and organisational performance. It is intended to allow the informants as much freedom in the interviews as possible as it is crucial to ensure that the interviewer does not in any way prejudge the evidence offered by them. Nonetheless, a list of discussion topics that the interviewer may use as an interview schedule has been developed. The topics are available to assist the interviewer if the discussion requires some prompting or guidance.

Key issues of the research

There are four key issues of this research:

1. To establish how managers formulate IT, that is, are highly systematised methodologies used or do the organisations respond to other stimuli?
2. To discover what is involved in implementing sound IT, for example are they implemented in much the same way as other investment decisions or are there any significant differences?
3. How does an organisation handle threshold decisions on IT?
4. How do they link IT to organisational performance?

Interview schedule

1. How does the organisation categorise Information Technology?
2. What architecture does the hardware consist of?
3. Does top management agree with the definition and compilation of the IT in the organisation?
4. Has the IT been tied to any other investment decisions?
5. Have IT projects been carefully planned and have these investment projects been documented in specific detail including cost-benefit or other types of financial analysis?
6. Have these investment projects been thoroughly discussed with potential users before doing the investment?
7. Is there a policy decision to centralise/decentralise IT in the organisation (including control of the IT)?
8. Have IT been coordinated with other interfacing functions?
9. Have operators and managers received appropriated training?
10. Does the IT Department have greater freedom to respond to exceptions when they occur while purchasing the IT?
11. How do they determine whether IT has an effect on organisational performance?

Case Study Protocols

At the centre of the protocol is a set of questions reflecting the inquiry. There are some characteristics that distinguish such a set of questions from those used in a survey. First, the protocol questions are set for the investigator and not the respondent. The questions are reminders or prompts to the investigator concerning the information that has to be collected. Second, each question should be accompanied by a list of sources of evidence that cover observations and interviewees comments. It is important to remember that a particular protocol is designed for data collection from a single case and is not intended to serve the entire project. Therefore, in multi-case situations a number of protocols will be required.

Figure 3: Field procedures

Field procedure

1. Find at least three informants for each case study. This is for purpose of data validation.
2. At least two informants should be senior managers, i.e. individuals who are either a member of, or reporting directly to, the board of directors or similar.
3. Obtain access to informants through a trusted intermediary wherever possible.
4. Make initial contact with the subject organisation at the highest level possible.
5. Find a friendly gatekeeper or guide as soon as possible.

6. Tape record all interviews.

7. Support verbal information with documentary evidence where possible.

8. Attempt to secure multiple interviews per site to reduce travelling time.

9. Attempt to interview informants in their offices rather than interview rooms.

10. Engage as many members of the staff as possible, such as secretaries and support people, in general conversation about the organisation.

A Guide to what is Required for the Case Study Report

The guide to compiling the case study report forces the investigator to think about the audience for which the case study is intended early in the process. The investigator should be concerned throughout the study with the design of the final report. An outline of the case study report should be included in the case study protocol. The protocol should indicate to what extent documentary evidence would be used in the final report. Case studies often produce large amounts of documentation and this may be used to produce an annotated bibliography.

Figure 4: Case study report guidelines

Case study report guidelines

The following are the primary headings that were established as the key focal points of the case study reports. These were established earlier in the research process so that they could be used by the author as a supplementary aide memoir in conducting unstructured interviews with informants.

1. Introduction and general background of the organisation.
2. The state of IT within the organisation.
3. The reasons for the current IT decisions.
4. The implementation of the IT decision.

Using a well-defined protocol, the case study method complies with the basic tenets of scientific method as it involves classification, observation, and descriptions of sequences and consequences. It is a misunderstanding to claim that the case study method is by nature qualitative. Wherever possible, purely descriptive data should be converted into quantitative data and statistical techniques applied. In addition, it is possible to conduct a survey within a case study situation and to use quantitative techniques in the analysis of data so collected. It is worth noting that qualitative data today is quantitative tomorrow. Quantitative and qualitative techniques are not conflicting but are rather complementary. There will, however, always be qualitative data that cannot be quantified. Although some situations may appear to be similar, they are in fact unique and statistical comparisons and correlations may actually lead to false assumptions and possibly to wrong conclusions. With regard to quantitative and qualitative research, it is important to remember that even in the physical sciences there are several disciplines (such as botany and zoology) that are primarily non-quantitative.

Summary and Conclusions

In conducting this research study a considerable amount of time and attention was devoted to the issue of methodology because the author sees this as the foundation on which the credibility of the research stands. Further as a PhD is primarily an apprenticeship in research, the author believes that as many different approaches to the research problem should be applied as possible. This belief is reinforced by the lack of universally accepted methodologies in research into information systems. Some of the methods that are used in this research rely on qualitative information, while others are based on highly quantitative approaches. The case study method was primarily used because it allowed IT to be examined in a holistic manner within a real life situation.

Furthermore, the case study research strategy accommodates the belief in multiple methods of data gathering and data analysis. The focus group could be used to obtain access to a number of experts and thus to widen the range of views collected. It is generally believed that the more informants the better. The focus group also provides an additional step towards triangulation. Finally, the presentation of the results to a number of leading consultants and practitioners could be performed to obtain further cross validation of the results.

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