

Research Methodologies in Information Technology Research: A Comparative Study

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Abstract

Today, IT and its related systems and services include every facet of the business and society. As a result, researchers in the IT field often consider the historical perspective regarding the issue at hand. Obtaining historical empirical research is usually the first step toward solving a problem. Additionally, the researcher usually needs or wants to know if any other organization has experienced a similar problem or situation. This is where case studies, interviews, and experiments become the preferred primary source of information.

The growth and advances in Information Technology (IT) have been stimulated by intense innovation and research efforts. Taking into consideration other research efforts in other industries, IT has shown to have one of the most funded research investments by organization and governments alike (Benbasat, 1996). This is due to the fact that IT and its services have become a critical resource for many organizations today driving profitability and boosting productivity.

This paper will attempt to analyze and discuss the types of research methodologies that have been used to conduct studies in the area of IT Project Management. This paper will also attempt to compare and contrast these methodologies and analyze the issues of bias and limitations of these methodologies.

Introduction

Research, on a whole, is aimed at establishing new awareness, understanding, comprehension, or knowledge regarding a specific issue, problem, or controversy. This diversity in the outcomes of research requires different research methods and techniques for different situations or questions. Towards that effort, research experts have introduced different research methodologies in an effort to provide researchers with the techniques they need to meet the diverse nature of research. These research methods are often classified based on either scope or the depth of the subject matter of the study.

Despite the fact that the field of IT research is fairly a new field, a variety of different research methods have been used in this discipline due to the diverse nature of IT and its related technologies. According to Benbasat (1996), the diversity in IT research can be seen in the array of topics that are being dealt with, the number of abstract areas being researched, and the multitude of research methods being utilized. Bruce et al. (2005) categorize the nature of IT research in seven distinct categories. These are:

1. Software development category, which encompasses the IT research efforts geared towards the enhancement of software, such as designing algorithms that provides instructions to hardware. Concepts such as programming, algorithm, logic design, and software engineering are dominant in this category.
2. Information practice category, which encompasses the IT research efforts geared towards augmenting the relationship between information and technology. In other words, IT is viewed as a process enabler by supplying

needed information. Concepts such as information manipulation (storage, retrieval, transfer, processing, and access) are dominant in this category.

3. Human-technology interaction, which encompasses the IT research efforts geared towards improving the relationship between IT and users. Dominant in this category are issues such as the how users interrelate with and use the variety of IT artifacts and the they need to make the best use out of these artifacts.
4. Applications to other disciplines, which encompasses the IT research efforts geared towards improving IT applications. In this category, the role of IT is viewed as a tool that is utilized by other disciplines to solve problems using IT artifacts.
5. Impact, which encompasses the IT research efforts geared towards the consideration of the impact that IT has on people as being a positive enhancement in their lives. Such impact is the rise of ubiquitous computing which refers to the third generation of computers where computing provides immediate response to people's needs for services or information by connecting the functionalities that exist in the real world (Weiser, 1993.)
6. Sanctioned, which encompasses the views and opinions of non-IT people, such as university faculty or other scientists with interest in IT, who can influence the shape and form of IT research and what constitutes an acceptable IT research.
7. Constructed, which defines those IT research efforts that have no specific category; therefore, the researcher based on personal interest or intention would define such a research effort. This category avoids neglecting those uncategorized research efforts which might prove to be relevant for IT.

Brooke (2002) on the other hand, categorizes the overwhelming majority of IT research in the application of IT in organizations. According to Brooke (200), such categorization includes the planning, utilization, and management of IT and its related resources in the organizational setting. Brooke (2002) further indicates that the nature of IT research is focused on answering the question of what works as far as the application of technology is concerned.

IT Project Management: The problem

According to the Project Management Institute (2004), Project management (PM) is the sum of all the practices, processes, and methods that are utilized to produce a service or a product. The implementation of IT and its related service is manifested through the implementation of projects. Managing IT projects have long been plagued with problems, which led to a high rate of failure in the successful completion of such projects (Standish Group, 1998).

Quantifying the success of an IT project is often evaluated based on the degree by which the project has adhered to certain success factors such as budget, deadlines, and meeting requirements (Standish Group, 1998). Towards the effort of reducing such high rate of IT project failures, many experts and researchers in the field of IT and PM have conducted studies and research efforts in order to define some blueprints to enable project managers to manage projects effectively and successfully. Those researchers and experts have utilized different research methodologies and techniques to arrive at their conclusions.

The remainder of this paper will focus on discussing and analyzing these different research methodologies and techniques that have been utilized by researchers on the subject of IT project management.

Research methods: A brief introduction

Research efforts, in general, can be classified as either quantitative or qualitative (Myers, 1997). Researchers originally utilized the quantitative research methods in studies involving a natural phenomena from a natural science; however, the scope of these methods have been extended to include social science studies in the form of surveys, experiments, and such formal methods as econometrics (Myers, 1997).

Utilizing a quantitative research approach requires the collection of hard data which then analyzed and manipulated using statistical methods to prove or disprove a hypothesis, with at least a 95% confidence interval.

Qualitative research methods were originally used to conduct studies that explain social trends or phenomena in social sciences (Myers, 1997). By its nature, qualitative research is subjective, exploratory, and open-ended. Examples of qualitative methods are semi-structured interviews where the participants in the study are asked a pre-defined set of questions which they respond to based on their opinions or attitudes toward the issue in the study. (Myers, 1997).

Research methodologies in IT

Selecting which research method to use in a research effort is dependant on certain factors. According to Bancroft et al. (1998), deciding which research method to use in a study is influenced by the degree of control that the researcher has over the over the experiment, and the topic or phenomenon that research the question addresses. Orlikowski & Baroudi (1991) examined 155 IT research articles published from 1983 to 1988. They indicate that IT research must not be dominated by a single research methodology since the utilization of a single research methodology can be restrictive. Orlikowski & Baroudi (1991) conclude that the positivist research methodology dominated the IT research efforts with 96.8% of all the IT research

articles they selected for their study. Following was the interpretive research methodology with 3.2% of all the IT research articles they selected for their study. Minger (2001) who indicates that the positivist approach is the current dominant methodology in IT research also shares this view. The domination of IT research by the positivist research method could be due to multiple theoretical, cultural, psychological and practical reasons (Mingers, 2001).

Positivist vs. interpretive research methods

Some researchers who utilize the positivist research method claim that research based on qualitative (interpretive) approach is not science (Heirschiem, 1985). Orlikowski & Baroudi, 1991) argue that the positivist research methods have been taken for granted which led to neglecting some apparent disadvantages of empirical research. On the other hand, some researchers who utilized the interpretive method of research claim that the positivist (quantitative) approach is not applicable in social systems studies (Heirschiem, 1985).

The strength of the positivist approach lies in its strict conformity to standards, methodology, statistical analysis and hypothesis testing. Researchers who utilize a positivists approach in their research view the world with complexity, which is based on fixed laws of causes. They believe that this complexity can be addressed by reductionism (Fitzgerald & Howcroft, 1998). Researchers who utilize a positivist approach often rely on quantitative analysis, confirmatory analysis, deduction, and experiments (Fitzgerald & Howcroft, 1998). These researchers aim to foresee and clarify causal relationships, and presume causal relationships between visible phenomena.

The positivist research method is often based on the assumption that reality is impartially given and that it may be illustrated using quantifiable measures, which are influenced by the researcher's instruments (Myers, 1997). Orlikowski & Baroudi (1991, p.5) indicate that the criteria for classifying a study as a being positivist is based on: "Evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and drawing of inferences about a phenomenon to increase predictive understanding of phenomena."

On the other hand, interpretive research is geared towards the understanding and gaining of new knowledge. While positivist research efforts focus on generalization and the formation of new theories about a certain phenomena, interpretive studies seek to comprehend the principles, attitudes, and the meaning of a certain phenomena (Kim et al., 2002). The guiding principle behind the utilization of interpretive research approach is to seek an understanding of how people interact with their environment intuitively.

Interpretive research, for the most part, involves the utilization of qualitative methods in order to understand and make sense of the data collected during the research effort. That is not to say that the type of data collected is the only ground on which an interpretive research effort is conducted. The most important distinctive aspect of an interpretive research effort is the underlying philosophical assumptions. One of the major tasks in an interpretive research is seeking meaning in context, which means that the object of the study must be set in its natural social setting (Klein and Myers, 1999). Orlowski and Baroudi (1991) indicate that the ultimate goal of interpretive research is to understand and comprehend how members of a social group enact and interpret their own realities. Orlowski and Baroudi (1991) further indicate that such comprehension and understanding is based on studying how these members

of a certain social group participate in their social processes which amounts to their social actions.

Researchers who utilize interpretive research approach seek to study events or reactions to knowledge that is predefined by culture and the correlated theoretical methods of the subjects of the study (Fitzgerald & Howcroft, 1998). Researchers who utilize an interpretive research approach have a mindset that there is no general truth. Therefore, interpretive researchers approach the research effort based on their own interpretations of the world and their own frame of reference (Fitzgerald & Howcroft, 1998).

Research methodologies using the positivist approach

Researchers who utilize the positivist approach rely on laboratory-like experiments, surveys, or case studies, which involve collecting and manipulating data about a certain phenomena in an effort to prove or disprove one or more hypothesis (Brooke, 2002). The IT research community has utilized the experimental, case study, and survey research methods extensively.

Experimental research

Experimental research consists of three main components: the sample, independent and dependent variables (Tanner, 2002). The sample consists of a number of test subjects randomly chosen from the population of available subjects. Independent variables are the conditions which may influence the behaviour of the subjects in the sample. Values of dependent variables may change as a result of a change in the independent variables. The changes are measured and submitted to statistical analysis to describe relationships between the variables. Typically

laboratory experiments are conducted in a more controlled manner than the field variety.

Jarvenpaa et al, (1985) indicate that the utilization of the experimental research method might present a limitation to the researcher since such research method is not always capable of addressing the proper problem in the field of IS. Jarvenpaa et al, (1985) further indicate that the utilization of such method of research is limited since the development of relevant and valid measurements can be a difficult process. Jarvenpaa et al. (1985) assert that the quality and variety of instruments available for experimental research are divisive in terms of data validity. To solve the validity of data issues, Pinsonneault & Kraemer (1993) suggest the use of a wider array of sample sizes to increase precision.

Darke et al. (1998) indicate that the use of experimental research method brings about issues regarding the validity of data. Such method is subject to the researcher's background, motivations, and the researcher's influence over the events. Darke et al. (1998) indicate that the utilization of multiple research methods could remedy these issues.

Survey research

According to Pinsonneault & Kraemer (1993), IT researchers utilize survey research extensively. Pinsonneault & Kraemer (1993) indicate that researchers who utilize a survey as a research method seek to generate quantitative representation of some characteristics of the population that the study is targeting. Therefore, such research method requires that standardization of information about the subjects targeted by the study. Survey research is characterized by the reliance on a small sample of the entire population. It is also characterized by the fact the major way of

data gathering is by asking participants a set of planned and predefined questions where the answers to these questions amount to the data to be analyzed.

According to Pinsonneault and Kraemer (1993), a survey research is utilized when:

- Testing an experience or an event that is contained by diverse natural settings.
- The main questions of interest about the experience or event are the “what” is happening and “how” it happens or happened. The answers to such questions will help in acquiring knowledge as to why such an experience or event has occurred.
- Control of the independent and dependent variables is not feasible or not required.
- The experience or event of interest must be examined and tested in its normal settings.
- The experience or event of interest takes place in the current time or the recent past.

Pinsonneault and Kraemer (1993) indicate the utilization of the survey method in IT and MIS research efforts is often misused and, therefore, has the following limitations:

- Single method designs where multiple methods are needed
- Unsystematic and often inadequate sampling procedures
- Low response rates
- Weak association between the items being analyzed and participants.

These methods share some common limitations despite the fact that each of these methods has contributed positively to the IT literature.

Research methodologies using the interpretive approach

According to (Landry & Banville 1992), despite the fact that the majority of research in IT has been dominated by the positivism approach, there are signs that the interpretive research approach is progressively being accepted within the IT research community. Landry and Banville (1992) argue that due to the heavy involvement of the human element in today's application of IT development and usage, IT development and utilization is becoming viewed as much a social process as it is a technical one. Therefore, the interpretive research approach can act as an attentive and influential insight to the understanding of human awareness and individual knowledge that the positivism approach could very easily fail to consider.

A central theme to the interpretive research approach is the diversifying of research methods or as it is often referred to as theoretical and methodological pluralism. (Landry & Banville 1992).

According to Orlikowski and Baroudi (1991), the strength of an interpretive research approach is its ability to link the human aspect of the research study with the technology under review. However, Landry and Banville (1992) indicate that the interpretive research approach presents the possibility of biased results based on the researcher's own perspective of phenomenon being studied. Such biased results can lead to generality stemming from one's own experiences and not based on a methodical and empirical review of actual data (Green, 2002).

Case Studies

Walsham (1995) indicates that when conducting an interpretivist research, the case study method is most appropriate. Researchers who utilize a case study as a research method, seek to investigate or illustrate a specific issue within a specific unit of study (Walsham, 1993). Yin (2003) indicates that documents, articles, interviews,

observations, archived records, and physical artifacts can be used to substantiate the findings of a research that utilizes a case study.

As far as IT research is concerned, the case study research method can be utilized exploratory IS research (Klein et al., 1999). A case study may extract certainty in better detail, while analyzing a larger number of variables than is permissible by other research methods (Galliers 1992). Benbasat et al. (1987) indicate that case study research can be carried out using a single case or multiple cases. Benbasat et al. (1987) indicate that the use of multiple-case studies are particularly useful when the research projects are descriptive, theory building or theory testing.

Yin (1994, p. 45) indicates that the multiple-case study research has unique advantages over the single-case research due to the fact that multiple cases make available more convincing substantiation of the findings and can lead to a more effective overall study. Therefore, case study research is particularly useful when the researcher wishes to collect data in greater intensity than is possible utilizing survey data.

Interviews

The most commonly used interpretive research method is the Interview method. Interviews help attain subjective interpretation of issues or views. The ultimate goal of the interview as a research method is to discover what people know (opinions, emotions, or attitudes) about a certain issue through the collection of information in a setting that is mutually agreed upon by the researcher and the participants in the research (Walsham, 1993).

According to Walsham (1993), interviews can be an effective research technique for large-scale research efforts, with many participants who represent the population. Data collected through interviews can be manipulated statistically and

compared with finding of other similar studies. Interviews, however, provide participants in the study with a little control during the interview. Such lack of control could lead to deviant ambiance, which could impact the validity of the data.

Critical research in IT

Researchers and experts in the field of IT have considered the critical research method as a viable option to the other forms of research methods currently utilized by IT researchers (Orlikowski & Baroudi, 1991). Critical research has been an established research methodology for IT research since the early 1990s. It presents a technique for the examination and assessment of information systems in a social setting (Walsham, 1993). The value of critical IT research lies in its ability to increase the understanding and awareness regarding the use of information systems in the social setting. Such value is established based on the nature and kind of information accessible to the researcher for the purpose of analysis (Walsham, 1993).

Similar in its approach to interpretivist, the critical research method is aimed at establishing an understanding of the impact that information systems have on society (Walsham, 1993). Critical IT research is also aimed at demonstrating how information systems contribute to the principles of social systems through the exploration and demonstration of how new information systems can contribute to the realization of social ideals (Orlikowski & Baroudi, 1991).

IT researchers who utilize the critical research method seek to establish an understanding of the impact that systems have on the work and social conditions of people. The primary aim of the researcher is to critique existing conditions so as to make people aware of the various existing forms of social domination and to enable the human actors to transform existing social structures (Orlikowski & Baroudi, 1991).

Despite the advantages that it has over other methods of research, the critical research method has certain limitations. Some researchers indicate that the critical method of research is deficient in its effectiveness as a research method.

One of the attributes of critical research is the fact that it takes into consideration the researcher's own assumptions about the phenomena, which could lead to biased findings (Orlikowski & Baroudi, 1991). Furthermore, critical research indicates that objectivity in describing the world does not exist. This tends to force the researcher to conduct the research not based on such values as emancipation, but rather on own assumptions

Conclusion

The main goal of this study was to analyze and discuss the trends and the variety of research methods that are being utilized by researchers in the field of Information Technology. Research trends and methods were analyzed based on the three major theoretical research methodologies being adopted by IT researchers today according to Orlikowski & Baroudi (1991). These are: positivism, interpretivism, and critical research methods.

A key finding in this research was that the IT literature is dominated by the positivist research approach, which utilizes surveys and experiments as the primary methods for research. This domination by the positivist research approach has prompted some IT researchers to encourage others approaches and methods of research in an effort to disconnect the researcher from the research method. As a result, the IT research has witnessed a movement towards other approaches to research, especially interpretive research, since IT has evolved to include social elements. Such elements are the impact information systems have on society and the individual. As far as the IT researcher is concerned, other methods of research may

require more time restrictions of the researcher and participants in comparison to their conditioned previous experiences of conducting research.

Orlikowski & Baroudi (1991) indicate that the determining factor in choosing which research approach or method to use should depend on uniqueness of the research phenomenon (Orlikowski & Baroudi, 1991). Overall, researchers should try to reduce or eliminate bias in their studies by choosing the appropriate research method and keeping theoretical uniformity.

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