IS/IT RESEARCH: A RESEARCH METHODOLOGIES REVIEW

DOUGLAS WARFIELD, MS

Centennial Convergence, Inc. USA

E-mail: dougwarfield@nc.rr.com

ABSTRACT

The evolution of information technology and information systems (IS/IT) has included the evolution of research methodologies to support the field. This has fueled the battle of research methodologies among researchers, predominantly caused by the foundations of social sciences and computer technology, which combine to form the business and technology application of information systems and information technology. The questions about appropriate research methodologies in the study of the IS/IT field are continually debated by researchers. The quantitative researchers, founded in technology such as computer science, lean toward the quantitative research method. While the qualitative researchers, founded in the behavioral sciences and organizational behavioral, lean toward the qualitative research method. In the syntheses of IS/IT and the supporting research, mixed method research has illustrated that combining computer science and human behavior requires use of both methodologies practically to advance the knowledge of IS/IT. This literature review looks at various research methodologies and their application to the IS/IT field.

Keywords: *Qualitative Research, Quantitative Research, Mixed Method Research, Positivist, Post Positivist, Interpretive.*

1. INTRODUCTION

In the Information Systems (IS) and Information Technology (IT) fields, often referred to collectively as IS/IT, researchers confront the intersection of both alternative paradigms and research methodologies in the development assessment of research methodologies for studies (Swanson & Holton, 2005). In confronting the paradigms of *positivism* and *interpretivism*, the researchers ultimately must strive for good research, following the standards of the scientific method and generate dependable data through professionally conducted practices (Cooper & Schindler, 2008; Swanson & Holton, 2005). As the research process has evolved, researchers have classified the research into three categories: 1) quantitative research, 2) qualitative research, and 3) mixed method research (Swanson & Holton, 2005).

The basis for the categorization relates to the different perspectives provided by different types of research fields. For the quantitative methodology, considered the foundation of modern science, researchers use the scientific method, which starts with the specific theory and hypotheses, and where

researchers quantitatively measure and analyze based on established research procedures (Swanson & Holton, 2005). For the qualitative research methodology, with its roots in the social sciences such as anthropology, history, and political sciences, researchers approach the research from the researcher as an observer perspective, with data collection and interpretation through contact with the field (Miles & Huberman, 1994). The mixed methods researcher uses the quantitative and qualitative research methodologies in some combination in the research of a study or series of studies (Swanson & Holton, 2005). Therefore, the importance of understanding the research methodologies in IS/IT studies, and in general, ultimately determine the value of the research overall; with research methodology design often the most critical component of a study.

The positivism or interpretivism perspective of the researcher(s) often influences and perhaps bias their choice. The differences in the research methodologies, therefore, should be clear to the researcher(s) before assessing the study or research needs for IS/IT research. Moreover, some researchers have questioned the research

methodologies regarding the diversity and the relevance to the practice of the research methodology chosen (Benbasat & Zmud, 1999; Vessey, Ramesh, & Glass, 2002). Particularly in IS research, researchers have also questioned whether the research methodologies applied advance the knowledge for the given subject (Benbasat & Zmud, 1999; Vessey, Ramesh, & Glass, 2002).

2. QUANTITATIVE RESEARCH

The positivist researcher approaches or views the world as objective and seeks measureable relationships among variables to test and verify their study hypotheses (Swanson & Holton, 2005). Their quantitative research process consists of five steps the researcher(s) perform (Swanson & Holton, 2005). The first step is determining the basic questions the researcher(s) intend to answer with the research study (Swanson & Holton, 2005). Researchers have generally categorized quantitative research as experimental, quasi-experimental, correlational, or descriptive (Swanson & Holton, 2005). In experimental research, the researchers design the specific conditions to test their theories or propositions, controlling the experiment and collecting their data to isolate the relationships between their defined independent variables and dependent variables (Swanson & Holton, 2005). These causal relationships are the systematic conjunction of two elements, which logically follow from one to the other (Lin, 1998). The non-experimental research, quasi-experimental, correlational, and descriptive, all requires the researchers to study phenomena without the ability to control or manipulate variables (Swanson & Holton, 2005). These methods require the researcher(s) to collect information from existing data and determine relationships without inferring causality, or to develop additional techniques for gathering the information, such as surveys for descriptive research (Swanson & Holton, 2005).

In the second step of quantitative research, researchers determine the participants in the study, which capitalizes on the advantage of using statistics to make inferences about larger groups using very small samples, referred to as *generalizability* (Swanson & Holton, 2005). This ability to use generalizability is a research methodology applicable in any research methodology, but has real advantage in quantitative research (Swanson & Holton, 2005). There are important ethical issues the researcher(s) must consider when using human participants in any research, and sometimes these factors may interfere with or preclude the research design, which the researcher(s) must include or consider in their planning (Cooper & Schindler, 2008; Swanson & Holton, 2005).

In the third step, selecting methods to answer questions, the researcher(s) identify variables, measures, and the research design to use in formulating specific research questions, methods, and participants of the study (Swanson & Holton, 2005). The researcher(s) must determine the dependent and independent variables and the quantities and quality of the data (variables) source (Miles & Huberman, 1994; Swanson & Holton, 2005). These types of variable measures include categorical, continuous, and ordinal (Swanson & Holton, 2005). In addition, the researcher(s) must understand the concepts of validity and reliability in their determination of measures, as failures to address validity and reliability often undermine or invalidate research studies (Swanson & Holton, 2005).

In the fourth step of quantitative research methodology, researchers' select statistical analysis tools for analyzing the data collected (Swanson & Holton, 2005). In the statistical analyses, the researcher(s) determines, based on the overall research design, how the variables describe, compare, associate, predict, and contribute to explain the analysis results and to answer the propositions of the study (Cooper & Schindler, 2008; Swanson & Holton, 2005).

In the fifth and final step, researchers perform the interpretation of the results of the analysis based on the statistical significance determined (Swanson & Holton, 2005). The quantitative research field has evolved numerous statistical applications to assess the data based on the data type classification, the type of research, and the propositions.

In the evaluation of the five steps used in quantitative research, the use of population sampling for generalization to the entire population, the coding of observations to measurements, and the statistical methodologies used in the analyses all seem to include activities that researchers from the interpretivist paradigm might conclude require interpretation for operation. One of the arguments provided by the qualitative (interpretivist) researchers is that all data collection and analyses include such elements of interpretation. Moreover, Vessey, Ramesh, and Glass (2002) conducted research on the types of research being used in the IS field, and reported on the internalist versus the externalist views advocated by other researchers as

differing reasons for the failed intellectual development of the IS field. The positivist/interpretivist paradigm differences among researchers for the IS/IT field, along with the question of the best direction, seem to suggest the need for a new or shifting paradigm.

3. QUALITATIVE RESEARCH

The qualitative research methodology starts from the philosophical assumptions that researchers bring with them their own worldviews and beliefs (Creswell, 2007). These assumptions include ontological beliefs, epistemological beliefs, axiological beliefs, rhetorical beliefs, and methodological beliefs (Creswell, 2007). Therefore, qualitative researchers acknowledge that their views invariably influence their research, and are the basis for the research results. As such, qualitative researchers rely on their beliefs and a variety of understandings in describing, interpreting, and explaining phenomena of interest (Creswell, 2007; Maxwell, 1992).

Qualitative research consists of five general designs: narrative, phenomenology, grounded theory, ethnography, and case study (Creswell, 2007). Qualitative researchers use narrative design when the study has a specific contextual focus, such as classrooms and students or stories about organizations, when the subject is biographical or a life history, or an oral history of personal reflections from one or more individuals (Creswell, 2007). The qualitative researchers use phenomenological research when the study is about the life experiences of a concept or phenomenon experienced by one or more individuals (Creswell, 2007). Researchers use grounded theory qualitative research to generate or discover a theory based on the study (Creswell, 2007). The qualitative researchers use ethnographical research when the subject involves an entire cultural group (Creswell, 2007). Qualitative researchers use the last design, case study research, to study one or more cases within a bounded setting or context (Creswell, 2007).

In qualitative research, just as it was in quantitative, validity of the study is also the most important consideration for the interpretivist in conducting research (Maxwell, 1992). As Maxwell (1992) posited, validity is a key issue in the debates over using qualitative research over quantitative research, where quantitative proponents criticized the lack of standards for assuring validity, such as lack of explicit controls for validity threats, quantitative measurement, and formal testing of the hypotheses. However, proponents of qualitative research argue that they have procedures for attaining validity, and that they are simply different from the quantitative approaches (Maxwell, 1992).

4. MIXED METHODS RESEARCH

As implied by the name, mixed methods research combines or mixes quantitative research and qualitative research in the same study or a series of studies (Swanson & Holton, 2005). As such, mixed methods research is the third major research approach or paradigm (Johnson, Onwuegbuzie, & Turner, 2007). For mixed methods research, the classifications include four types (Swanson & Holton, 2005). In the first type, complementary, researchers combine the results of one method with the results of the other method (Swanson & Holton, 2005). In the second type, development, the results from one method help develop or inform the other method (Swanson & Holton, 2005). For the third type, initiation, the researchers recast the results from one method to questions or results from the other method. Lastly, in the fourth type, expansion, researchers use different methods to extend the breadth or range of inquiry (Swanson & Holton, 2005).

The recent historical context of mixed methods research evolved from researchers and methodologists who believed in both qualitative and quantitative research methodologies for addressing their research questions (Johnson, et al., 2007). As such, the mixed methods research results in a synthesis that uses ideas from qualitative and quantitative research (Johnson, et al., 2007). In addition, the researchers applying the concept of multiple operationalism, or triangulation, argue that the validity of findings from two or more research methods (QUAL/QUAN) enhances the belief that the results are valid and not artifact results of the single research methodology used (Johnson, et al., 2007).

5. COMPARISON OF QUANTITATIVE, QUALITATIVE, AND MIXED METHODS RESEARCH

In the comparison and evaluation of research methodologies, specifically for IS/IT, the first construct for evaluation is the overall purpose of the research methodology in an overall evaluation of research and studies in IS/IT. Rumrill, Fitzgerald, and Ware (2000) created guidelines for analysis of research articles and determined that the method section of the research article "delineates how the research questions were addressed and/or

the hypotheses were tested" (p. 259). Rumrill, et al. determined that the research method contained the primary source for determining the validity of the study. Therefore, the research methodology ultimately determines validity in the research and the value of the research.

The academic discipline of IS derives from theories of computer science, organizational behavior, organizational theory, and cognitive psychology (Vessey, et al., 2002). As such, relevant core theories from both social sciences and technology seem appropriate to the field of IS and its larger parent, the IT field. However, these elements contribute to different foci and viewpoints from the IT community (Vessey, et al., 2002). In the study on the existing scholarly journals published research for IS, Vessey, Ramesh, and Glass (2002) concluded that the field is too broad and diverse to develop a unified focus. Vessey, et al.'s (2002) view differed from Benbasat and Zmud's (1999) view, who posited that the field would benefit from more controlled research diversity, and believed that the reliance on reference disciplines has created a research problem in the IS field. As such, the question of the type(s) of research to use, quantitative, qualitative, or mixed methods, seems to suggest benefits from more diversity in the research methodologies, particularly in the context of covering the diversity of the academic discipline using theories from the broad spectrum already available from other disciplines such as cognitive psychology and organizational behavior. In their findings, Vessey, et al. (2002) concluded that IS researchers should use theories derived in their reference disciplines to further develop theories to provide the IS field with new understanding.

Benbasat and Zmud's (1999) research, which correlated to the Vessey, et al. (2002) research, raised concern about the relevance of academic research in the IT/IS field. In part as response to previous publications about the practical relevance of IS research published in the leading journals and other publications such as the Business Week magazine, Benbasat and Zmud's (1999) research questioned whether IS research helped IS professionals address the problems and challenges they faced. Benbasat and Zmud's (1999) offered nine recommendations for increasing the relevance of published research, and concluded that the academic researcher is more concerned with issues of justification, while practitioners are more concerned with the relevance of the research to practical application.

Lee (1999) challenged Benbasat and Zmud's (1999) research, contending that they restricted themselves to the perspective of positivism, noting that positivism in social sciences refers to the belief that research should emulate the research approaches of natural sciences. Lee further contended that natural scientists typically engaged in theory-driven rather than practice-driven research, passing through the theory-driven activities of normal science to their possible application for solving real-world problems. Lee further established the argument by calling for empirically grounded rigorous understanding of relevance first. Lee concluded that positivist research was not the only option. Lee's point about the other potential research methodologies, such as interpretivist research and mixed methodologies provided valuable insight into the issues of IT/IS research diversity, application to practice, and the possible restrictive nature of positivists' only view of the field.

There appears to be a clear case for using qualitative research methodology in the IS/IT field. The use of existing proven theories developed through qualitative research in the fields such as education, psychology, social sciences, and organizational behavior, perfectly fit the human elements component of the IT/IS field. These qualitative studies included theories and models such as the motivators of productive work behaviors, behavioral reasoning theory, and justice models and attitudes (Ambrose, Hess, & Ganesan, 2007; Ferratt & Short, 1986; Westaby, 2005).

In order for the IS/IT field's researchers, largely dominated by quantitative research and postivists, to adopt qualitative research methodology, practitioners and academic researchers in IS/IT required an understanding of the value-added, rigor, and validity of qualitative research methodology. Creswell and Miller (2000) noted that the notion of validity in qualitative inquiry increasingly perplexed researchers, particularly for novice researchers. Creswell and Miller (2000) also noted that procedures for validity included researchers' strategies for establishing study credibility. Investigators using quantitative research are most concerned about inferences from psychometric instruments' test scores and the internal and external validity of the experimental designs (Creswell & Miller, 2000). In contrast, qualitative researchers' are concerned with validity related to the views and activities of people in the study, such as study participants, reviewers, and the researchers' conduct (Creswell & Miller, 2000).

Creswell and Miller (2000) determined that the postpositivists recognize and support validity through quantitative methodology, using procedures for establishing validity using specific protocols, while the constructivist or interpretivist believed in pluralistic, interpretive, open-ended, and contextualized perspectives toward reality.

From the qualitative viewpoint, Creswell and Miller (2000) developed nine validity procedures important in adding validity and credibility to the research, which also apply when mixed methods research using qualitative research is used. Researchers implement the triangulation validity procedure by converging multiple and different information sources (Creswell & Miller, 2000). Cox and Hassard (2005) provided research on flexible and innovative uses of triangulation in organizational behavior, and encouraged innovative ways for using the valuable research procedure. Validity from member checking consists of taking participants input collected and interpreted in the study, back to the participant for their review about its credibility (Creswell& Miller, 2000). The audit trail validity procedure requires the researcher(s) to document all research decisions and activities for later examination for trustworthiness of the study findings (Creswell & Miller, 2000). In the disconfirming evidence validity procedure, investigators search through the data for consistent and/or contradictory evidence based on preliminary themes and categories established (Creswell & Miller, 2000). The prolonged field engagement validity procedure requires researchers to conduct repeated observations, and to build trust relationships with participants in the field, so participants are comfortable disclosing information (Creswell & Miller, 2000). The validity procedure of using thick, rich description has researchers collect as much detail as possible, which establishes credibility, allowing readers to feel transported to the setting or site (Creswell & Miller, 2000). In the researcher reflexivity validity procedure, the researchers report their personal beliefs, values, and biases that could shape their investigation, which helps those reading the study understand the researchers' positions and views in the research (Creswell & Miller, 2000). Close collaboration with participants validity produces credible data and helps researchers to respect, question, support, and understand the participant(s) (Creswell & Miller, 2000). The last validity procedure, peer review or debriefing, helps add credibility by having someone familiar with the research review the researchers' work; the more objective (detached from the study)

the reviewer, the better the results (Creswell & Miller, 2000).

A critical observation about qualitative validity procedures, relevant to the IS/IT field of research, particularly in consideration of the previously mentioned research that reported IS research deficiencies, is that several of the validity procedures just mentioned require researchers to get closer to the participants of the study. This aspect of closer association with participants for qualitative research validity, illustrates the more holistic and humanistic traits required in qualitative research. In previous research for IS/IT, particularly project management case studies of IS development and implementation projects, the lack of involvement by participants and the end users of the systems was cited as a common cause for failures of systems design and implementations, and for deficiencies in IS/IT research. This also may help explain the past issues of research associated with practice relevance reported by (Benbasat & Zmud, 1999; Vessey, et al., 2002).

In the evaluation of mixed methods research use in international business, Hurmerinta-Peltomäki and Nummela (2006) conducted a systematic review of empirical studies in the years from 2000 to 2003 using International Business (IB) journals, focusing on four major journals: International Business Review, Journal of International Business Studies, Journal of World Business, and the Management International Review. Hurmerinta-Peltomäki and Nummela (2006) concluded that research strategies that combined both types of quantitative and qualitative data and analysis gained the most from validity through triangulation, and from a more comprehensive illustrative description of the phenomenon. Hurmerinta-Peltomäki and Nummela (2006) also concluded mixed methods applied in several phases of the research process, particularly later in the study, produced more new knowledge and theoretical contribution. Mixed methods research advantages are undeniable; however, mixed methods research places additional demands on researchers, including the need to acquire the methodological skills required for mixed methods research, the resources needed for conducting and coordinating different phases of the research process, and thorough advanced planning of the research process (Hurmerinta-Peltomäki & Nummela, 2006).

The research by Hurmerinta-Peltomäki and Nummela (2006) shows that mixed methods research certainly offers substantial benefits in

International Business research. Therefore, the value-added to IB would certainly transfer or at least translate to the IS/IT field. However, in consideration of mixed methods research for IS/IT, researchers should heed the warnings of additional resource demands required, particularly in the phases and planning of mixed methods research (Hurmerinta-Peltomäki & Nummela, 2006; Miles & Huberman, 1994; Swanson & Holton, 2005). In addition, to apply the mixed methods research the IS/IT researchers must understand when and how to use mixed methods research.

According to Rocco, Bliss, Gallagher, and Perez-Prado (2003), in the research planning for mixed methods research, the researcher should consider three stages. In the first stage of mixed methods research, the researchers determine whether their study is an exploratory or confirmatory study (Rocco, Bliss, Gallagher, & Perez-Prado, 2003). In the second stage, researchers determine the type of data collection and operation (Rocco, et al., 2003). The third stage concerns the type of data analysis and inference (Rocco, et al., 2003). These same stages exist in both quantitative and qualitative research methodologies. When using mixed methods or mixed research for a study, the basic components of both quantitative and qualitative research methodologies should exist. The research shows that combining the methodologies results in all the components of both, and does not suggest the elimination or amalgamation of any components.

The rationale for mixing methodologies in a study, according to Leech and Onwuegbuzie (2010), is participant enrichment, instrument fidelity, treatment integrity, and significance enhancement. .Participant enrichment involves using both quantitative and qualitative techniques to optimize the sample (Leech & Onwuegbuzie, 2010). Instrument fidelity involves use of both methodologies' techniques in maximizing the instrument(s) appropriateness (Leech & Onwuegbuzie, 2010). Treatment integrity involves mixing both methodologies' techniques for assessing the fidelity of interventions, programs, or treatments (Leech & Onwuegbuzie, 2010). Lastly, significance enhancement involves mixing both methodologies' techniques for maximizing interpretation of findings (Leech & Onwuegbuzie, 2010).

As the rationale provided by Leech and Onwuegbuzie (2010) suggests, in comparison to either quantitative or qualitative methodologies, the main benefits of mixed methods research comes from capitalizing on the strengths of the methodologies and reinforcing one's techniques with the techniques of the other. The results of the comparison of the three methodologies, therefore, restate the differences between quantitative research and qualitative research as defined previously, and mixing adds the techniques available from both to the study, allowing researchers to take advantage of the strengths of both.

6. FUTURE CONSIDERATIONS FOR MIXED METHODS IS/IT RESEARCH

In research study, Johnson, Onwuegbuzie, and Turner (2007) posited eleven issues as potentially needing consideration in future research related to mixed methods. The first is whether researchers and research methodologists reach broad agreement about stages of the research process where mixing can occur (Johnson, et al., 2007). In IS/IT research, this agreement is imperative in designing methodologies where researchers have standard taxonomy for communicating research design. The second issue is the need to establish strategies and theories for integrating quantitative and qualitative data (Johnson, et al., 2007). The third issue is deciding what philosophical approach or philosophy of science best serves the integration of mixed method approaches and perspectives (Johnson, et al., 2007). Johnson, et al. agreed with the pragmatism philosophy. The fourth issue is whether mixed methods research requires a detailed set of methodological positions (Johnson, et al., 2007). This particular issue might be valuable for IS/IT research using mixed methods, if an approach such as design templates would characterize known theoretical intersections and interactions between business and technology. The fifth issue is whether dominant design (QUAN/qual - notation similar to dominant and recessive gene notation) is required (Johnson, et al., 2007). The sixth issue is whether validity, trustworthiness, or credibility of mixed research is important (Johnson, et al., 2007). The seventh issue is how the three research paradigms exist, coexist, or transform going forward (Johnson, et al., 2007). The eighth issue is whether human research requires a separate contingency theory (Johnson, et al., 2007). The ninth issue is whether future definitions include the logic of mixed research (Johnson, et al., 2007). The tenth issue questions whether the field is able to develop a typology of mixed methods designs (Johnson, et al., 2007). The eleventh and final issue is whether

branches of the core mixed research could emerge by design (Johnson, et al., 2007).

The eleven issues posited by Johnson, Onwuegbuzie, and Turner (2007) all relate to the future evolution of the mixed methods research and mixed research (mixed methods within a broader mixed research). The IS/IT mixed methods researchers should attempt to include some of these issues as components of their research to help shape the future direction and contribute to the overall body of knowledge in mixed methods research. This not only helps advance the field of study but also helps shape further paradigms or disciplines by transforming the current business and technology disciplines and by insuring their inclusion in the future theories and philosophies.

7. CONCLUSION

The IS/IT field resides in the strata between both business and technology, as illustrated in the naming of the School of Business and Technology, common in universities (e.g. Saint Mary's Graduate School of Business and Technology). This combination of technology and business invariably includes the combining of different disciplines and paradigms. For example, the different research foundations, scholarly and academic journals used by technology based research often approaches research methodology from the quantitative methodology founded on the scientific method and using experimental and observed measurements to develop theories and advance knowledge in the field (Swanson & Holton, 2005). Business research is typically associated with organizational behavior and founded more on the qualitative research methodology often used in support of social sciences, anthropology, cognitive psychology, and education (Miles & Huberman, 1994; Swanson & Holton, 2005). The combining of these two paradigms or disciplines, generally defined as business information technology, which combined human resources and organizational behavior with information systems and computer technologies, evidently required combining the existing theories and research of both disciplines, and required methodologies to advance the knowledge of both disciplines as one. The evolution of the research methodologies to combine quantitative research and qualitative research into mixed methods provided the obvious solution. Moreover, while quantitative and qualitative research methodologies are perfectly valid and applicable in many research situations, in the IS/IT research field, to understand thoroughly the business and technology disciplines

combined, IS/IT researchers may turn to mixed methods research more often.

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