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Quantitative Approaches for Software Project Research: Issues of Sampling, Validity, Reliability, and Bias

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Abstract

There are many quantitative research approaches used to conduct studies on software project management. This paper sets out to compare and contrast the approaches with a critical examination of the issues of sampling, validity, reliability, and bias. The study found that researchers more frequently use the descriptive and quasi-experimental types of quantitative research in software project research. The study also found that researchers use descriptive approaches to collect information about a phenomenon in a discipline. The reason is that quantitative approaches tend to be objective, deductive, and generalizable. Similarly, the study found that researchers use the quasi-experimental research to identify problems with current practice, justify or condemn current practice, make judgments by making comparison between the current and the experimental variables. Although, it may cost more money, time, and effort, the study recommends that it is very important to choose a sample size that will be able to accomplish reliability and generalizability. This study believes that there is the tendency for researcher's bias in most research. The paper concluded that the quality of a research does not only depend on the adequacy of its planning, but also on the productivity of the measurement processes that are used.

Keywords: quantitative methods, descriptive approaches, quasi-experimental research, software project, sampling, validity, reliability, and bias.

Background

Quantitative research approaches in research are so attractive in software project management research because they offer various comparative angles from which a topic can be approached, especially as quantitative research is a methodical and organized process of using

numerical data to obtain information about the world (Burns & Grove, 1993; Cormack, 1991; Corner, 1991). The three major types of quantitative research are descriptive, quasi-experimental, and experimental. Researchers more frequently use the descriptive and quasi-experimental types of quantitative research in software project research (Burns & Grove, 1993). However, each methodology has its advantages and drawbacks that yield similar results if the sapling is effectively done.

According to Project Management Institute [PMI] (2017), software project management involves the application of knowledge, tools, and techniques to manage the development, adaptation, or upgrade of software projects subject to users' requirement. In the 21st century, interest in IT and software project management has grown dramatically (Debbie, Timothy, & Mark, 2007; Maizlish & Handler, 2007). IT companies across the globe hare under the pressure to increase their software project success to win new contracts and improve profitability. Unfortunately, large numbers of software projects fail despite the improvement in project management processes (Maizlish & Handler, 2007; Standish Group, 2004). Researchers have thus begun to study causes of failure of software projects, and many of them tend to use most frequently the quantitative approach in software project research (Gokaydin, 2007; Norri & Walker, 2004).

Purpose of the study

This study is a comparative analysis of the quantitative research approaches used to conduct studies on software project management. It examines the impact of sampling, validity, reliability, and bias on these methods of research.

Research Question

The research questions presented are based on the problems identified in this study. Answers to the research questions could produce practical recommendations on the preferred quantitative research methods to conduct software project management research.

RQ1. What quantitative research methods do researchers use to conduct research in software project management? The independent variable (IV) is quantitative research methods. The dependent variable is software project management.

Research Hypotheses

The following research hypotheses will guide this study:

$H_0$1: There will be no relationship between quantitative research methods and software project management.

H_A1: There will be a relationship between quantitative research methods and software project management.

$H_0$2: There will be no relationship between descriptive, quasi-experimental, and experimental methods and software project management.

H_A1: There will be a relationship between descriptive, quasi-experimental, and experimental methods and software project management project management.

Conceptual Model

Figure 1: Conceptual Model

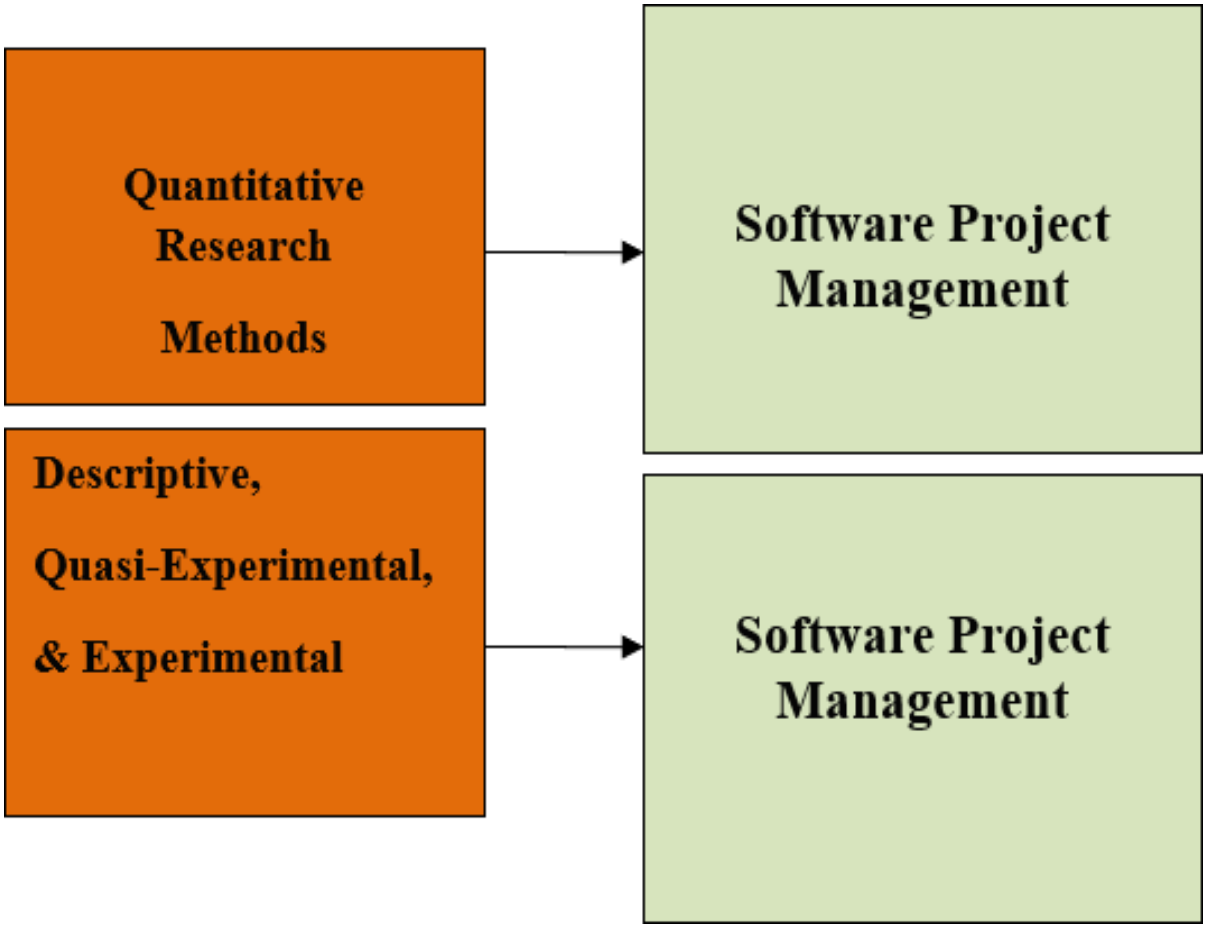

Figure 1 graphically illustrate the conceptual model for this study

Literature Review

The increase of interest in software application has ignited a concomitant spike in research in the various departments of components of area (Anantatmula & Thomas, 2010; Bandura, 1997; Benetti et al., 2009). Project Management Institute [PMI] (2017) defines a project as a temporary work embarked upon to deliver a special product, service, or outcome. There are different types of projects some of which include construction, manufacturing, product, capital, development, and software projects. However, software project management

involves the application of knowledge, tools, and techniques to manage the development, adaptation, or upgrade of software projects to meet users' requirement (PMI, 2017).

Some of the methodologies include Agile, RUP, Scrum, XP, SSADM, PRINCE2, XP, and Crystal. According to Sinha (2010), *Agile* is an adaptive approach, which relies on the philosophy that change is inevitable. It advocates a short delivery cycle, just-in-time analysis, close collaboration, and high visibility. Agile methods divide projects into minor boxes known as iterations, which further divide into scrums and sprints. A single iteration generally spans for two to four weeks to complete a deliverable set. Generally, the first iteration involves preliminary scoping, planning, and initial designing (Sinha, 2010). Subsequent iterations produce hands-on development.

After completion of one development iteration, the project manager will show demos and collect feedback (Sinha, 2010). The project team will then implement any changes needed in the working software in subsequent iterations (Sinha, 2010). Agile methods include agile modeling, agile unified process, dynamic systems development method, extreme programming, feature driver development, open unified process, and velocity tracking.

One of the benefits of this model is that it incorporates needed modifications in the software to avoid last-minute surprises. The future of software projects seems to lie in the use of highly agile and interactive development methods such as extreme programming, even though highly structured management methodologies such as RUP, a software design methodology created by the Rational Software Company, can still be valuable for large, static software projects (Sinha, 2010). RUP uses an iterative approach because it is a software product designed and built in a succession of incremental iterations. Each of the iterations includes some of the development disciplines - requirements, analysis, design, implementation,

and testing (Sinha, 2010). RUP has four project life cycle phases namely inception, elaboration, construction, and transition (Sinha, 2010).

The inception phase is where you build the business case, pass the life cycle objective, or cancel/redesign the project. In the elaboration stage, the PM sets up the basic architecture, mitigate risk; and pass the life cycle architecture milestone. At the construction phase, the PM builds the software system and codes the software. Finally, at the transition phase, the PM moves the software system from development to production, tests the software, and trains users.

The iterative approach leads to higher efficiency (Beck, 1999). Testing takes place in each iteration, not just at the end of the project life cycle, making it easier to detect problems earlier and easier and cheaper to resolve them. According to Beck (1999), RUP does not use a waterfall approach for software development and is particularly applicable on larger software projects. The phases of requirements, analysis, design, implementation, integration, and testing are not done in strict sequence (Beck, 1999).

Scrum is a software development process containing practices and predefined roles that enable the creation of self-organizing teams (Sinha, 2010). Scrum recognizes changes and focuses on dealing with emerging requirements. The main roles in scrum teams are scrum master, scrum team, and product owner. Scrum master is the role held by a project manager who coordinates and maintains the processes. He or she is the one who facilitates scrum processes and coordinates with the product owner and the development team (Sinha, 2010). However, the product owner is a key stakeholder representing the end user; he/she also serves as a proxy customer to the team. He or she is the one who prioritizes the requirements. The product owner answers team questions and provides directions to the team. The product owner

needs to have good communication skills, willingness to go deeper into understanding the product and its market value, good user interface skills, and some technical background (Sinha, 2010).

Team might be a cross-functional group of five to nine members doing analysis, design, implementation, and testing (Sinha, 2010). Software project management like any other project goes through the application and integration of the project management processes of initiating, planning, executing, monitoring and controlling, and closing (PMI, 2017). The goal is to have a successful project delivery that, according to Kerzner (2003), has achieved the desired objectives.

The dramatic growth and increase in IT and software project management across the globe in the last 15 years continues to put pressure on these companies to increase their software projects and techniques efficiency in order to win new contracts and improve profitability (Anandamela & Thomas, 2010; Gokaydin, 2007). Despite the improvement in project management processes and project manager certifications, there are still large numbers of IT/software projects that are not successful (Debbie, Timothy, & Mark, 2007; Maizlish & Handler, 2007; Standish Group, 2004). According to Standish Group (2004), only 29% of IT/software projects succeeded, meaning that 71% of those projects failed. Hartman and Ashrafi (2002) did a study on project management in the information systems and information technologies and found that many IT and software projects failed. Organizations that value software project management then started wondering how much investment and resources they should allocate to project management (Gokaydin, 2007).

The failure rate of IT and software projects creates an alarming situation leading to further research in software and IT project management. Studies indicate that researchers tend

to use the quantitative approach most frequently in software project research (Gokaydin, 2007; Lindbergh, 2009; Norri & Walker, 2004).

Quantitative Research Methodology

Quantitative research is a methodical and organized process of using numerical data to obtain information about the world for research purposes (Burns & Grove, 1993; Cormack, 1991; Corner, 1991). It is objective, deductive, generalizable, and numerical (Cormack, 1991). Benetti, Reginato, and Martins (2009) define quantitative research method as involving the collection and analysis of numerical data and the application of statistical test.

Comparatively speaking, whereas quantitative research tends to have objective analysis, qualitative research appeals more to subjective components (Benetti, et al., 2009). Quantitative research is also generalizable and that is especially important in research. Maxwell (1992) defines generalizability as the extent to which one can extend the account of a particular situation or population to other persons, times, or settings than those directly studied.

Quantitative research is one of the major methods and designs for the collection, measurement, and analysis of data. The majority of software project research is quantitative (Gokaydin, 2007, Cooper &Schindler, 2011). Part of it is that quantitative studies tend to be objective, deductive, and generalizable (Vogt, 2007). In quantitative study, the category of data determines the statistical procedures a researcher can use to analyze the data (Lindbergh, 2009; Zumbo & Zimmerman, 1993). For most quantitative studies, three categories of data are usually collected: nominal, interval, and ratio commonly referred to as levels of measurement (Zumbo & Zimmerman, 1993).

Quantitative Research Approaches

As mentioned above, there are three most popular approaches in quantitative research namely descriptive, experimental, and quasi-experimental. Although two of those three - descriptive and quasi-experimental are more associated with software project management, the paper will explain all the three approaches to create a general understanding of the approaches. Lindbergha (2009) uses the quantitative, non-experimental, correlational design to study the relationship between project manager capability, organizational culture, and project outcomes. He bases most of his literature on IT/software projects. MacCallum, Zhang, Preacher, and Rucker (2002) advocated the use of quantitative design in social science research in his study on the practice of dichotomization of quantitative variables.

Descriptive Approach

Researchers use descriptive approaches to collect information about a particular phenomenon in a discipline (Leedy & Ormrod, 2001; MacCallum et al., 2002). Descriptive designs do not involve the manipulation of variables or the determination of causality. A descriptive survey applies generally in scenarios of studying a current day condition or phenomenon and historical analysis used for understanding past events or conditions (Leedy & Ormrod, 2001).

There are three types of descriptive research design namely simple, comparative, and correlational. A simple descriptive research design applies when collecting data to describe persons, organizations, settings, or phenomena (Leedy & Ormrod, 2001). A comparative descriptive design applies when the researcher describes two or more groups of participants. A correlational research design applies when describing the statistical association between two or more variables (Leedy & Ormrod, 2001).

Experimental Approach

Experimental research is one in which the researcher attempts to maintain control over all factors that may affect the result of an experiment (Gall, Borg, & Gall, 2003). In doing this, the researcher attempts to determine or predict what may occur. According to Gall, Borg, and Gall (2003), in an experimental design, the researcher tries to manipulate the participants, in order to change the behavior of the participants. Part of the procedures is to assign participants to different conditions, and to measure variables of interest. All other variables in the controlled experiments remain fixed before the data collection begins. The researcher uses methods of physical, selective, and statistical control for the experiment (Gall, Borg, & Gall, 2003).

According to Gall, Borg, and Gall (2003), experimental studies involve manipulation, control, and randomization. Manipulation involves a situation where the researcher causes a change of behavior of the research participants. Controlling occurs when the researcher manages or puts conditions on the situation. Randomization is a situation whereby the researcher assigns participants to any group by chance (Gall, Borg, & Gall, 2003).

Generally, there are steps involved in conducting an experimental study. They include identifying and defining the problem; formulating hypotheses and deducing their consequences; constructing an experimental design that represents all the elements, conditions, and relationships of the consequences (Gall, Borg, & Gall, 2003). Others include conducting the experiment; compiling raw data and reducing it to usable form; and applying an appropriate test of significance (Gall, Borg, & Gall, 2003).

According to Gall, Borg, and Gall (2003), there are two types of validity in experimental research - internal and external. Internal validity seeks to know if the experimental treatment makes the difference in this specific instance rather than other extraneous variables. External

validity on the other hand seeks to know what populations, settings, treatment variables, and measurement variables can this observed effect be generalized (Gall, Borg, & Gall, 2003).

Quasi-experimental Approach

Quasi-experimental designs are usually constructions that already exist in the real world (Creswell, 2009; Burns & Grove, 1993). A quasi-experimental design will have some sort of control and experimental group, but these groups probably were not randomly selected (Creswell, 2009). Random selection is usually where true-experimental and quasi-experimental designs differ. Researchers use quasi-experimental design to examine causality where it is not feasible to use the experimental method (Creswell, 2009).

It is a design in which the researcher manipulates an independent variable to measure its effects on a dependent variable, and the researcher does not randomly assign participants to comparison groups (Creswell, 2009). In order to improve a quasi-experimental design, the researcher needs to match the comparison groups on characteristics that relate to the dependent variable (Burns & Grove, 1993; Creswell, 2009). The following paragraphs compare and contrast the descriptive and quasi-experimental designs more critically.

Compare Quasi-experimental and Descriptive Approaches

Quasi-experimental research uses non-equivalent control groups (Burns & Grove, 1993). Similarly, descriptive research also does not use control groups. Researchers use descriptive approaches to collect information about a particular phenomenon in a discipline (Leedy & Ormrod, 2001; MacCallum, Zhang, Preacher, & Rucker, 2002). Descriptive designs do not involve the manipulation of variables or the determination of causality (Leedy & Ormrod, 2001; MacCallum, Zhang, Preacher, and Rucker, 2002). Similarly, researchers use the quasi-experimental research to identify problems with current practice, justify or condemn current

practice, make judgments by making comparison between the current and the experimental variables.

A descriptive survey applies generally, in scenarios of studying a current day condition or phenomenon and historical analysis used for understanding past events or conditions (Leedy & Ormrod, 2001). Similarly, quasi-experimental research studies current day and real world conditions. Descriptive study has external validity and quasi-experimental research has external validity more as if real world conditions (Burns & Grove, 1993; Leedy & Ormrod, 2001). The both designs are feasible given time and logistical constraints.

Contrast Quasi-Experimental and Descriptive Approaches

The quasi-experimental design studies causality in experiments. While the descriptive approach studies variables as they are without trying to find out what causes something to happen (Burns & Grove, 1993; Leedy & Ormrod, 2001). Quasi-experimental design tends to change the behavior of test participants while descriptive design does not worry about changing behavior of test participants (Burns & Grove, 1993).

Descriptive research answers the questions: what, how, and why something is happening. Whereas, quasi-experimental design answers the question, does something cause an effect? (Burns & Grove, 1993; Leedy & Ormrod, 2001). Quasi-experimental research is deductive because researchers design all experiments to test hypotheses whereas qualitative research deals with the heuristic hypothesis-generating (Burns & Grove, 1993; Leedy & Ormrod, 2001; MacCallum, Zhang, Preacher, & Rucker, 2002).

Methodology

The purpose of this study was to compare quantitative researcher methodologies used in software project management research. The goal was to find out which quantitative research

methodologies are do researchers use. The study created a relationship between scores associated with the independent variable (IV) namely quantitative research methods and the dependent variable (DV) namely software project management. This chapter discussed the research questions and hypothesis.

RQ1. What quantitative research methods do researchers use to conduct research in software project management? The independent variable (IV) is quantitative research methods. The dependent variable is software project management.

Research Hypothesis

$H_0$1: There will be no relationship between quantitative research methods and software project management.

H_A1: There will be a relationship between quantitative research methods and software project management.

$H_0$2: There will be no relationship between descriptive, quasi-experimental, and experimental methods and software project management.

H_A1: There will be a relationship between descriptive, quasi-experimental, and experimental methods and software project management

Table 1. *Summary of Null Hypotheses, Independent, and Dependent Variables*

Hypothesis Number	Independent Variables	Dependent Variables
$H_0$1	Quantitative Research Methods	Software Project Management

$H_0$2	Descriptive, Quasi-Experimental, & Experimental Methods	Software Project Management

Research Design

This study adopts the survey design. Surveys are useful ways not only to determine the attitudes of people on particular questions but also to look for patterns of cause and effect among many variables (Cooper & Schindler, 2008). The selection of this research design is in line with the post-positivist philosophical assumptions (Creswell, 2009). Post-positivist research principles emphasized meaning and the creation of new knowledge, that can support committed social movements, that is, movements that aspire to change the world and contribute towards social justice. The characteristic of post-positivist research include: research is broad rather than specialized; theory and practice cannot be kept separate; the researcher's motivations for and commitment to research are central and crucial to the enterprise; the idea that research is concerned only with correct techniques for collecting and categorizing information is now inadequate (Creswell, 2009).

Methodological Model

The research instrument employed a five-point semantic differential Likert scale with values ranging from 1 *Strongly Disagree* to 5 for *Strongly Agree* (Carifio & Perla, 2008). Surveys use Likert scales for measuring attitudes, opinions and disposition by asking a user to make value judgments, which is relevant for this study (Carifio & Perla, 2008).

Likert type data involve an ordinal level of measure. Given ordinal level of measurement, Spearman's rho, a nonparametric statistical procedure became the statistical tool

to test the research questions and hypotheses. Furthermore, the data were screened for normality with skewness and kurtosis statistics.

Five out of seven distributions had significant negative skews, and six out of seven distributions were outside the range of normality for kurtosis. Since most of the distributions had significant negative skews and were outside the range of normality, the use of Spearman's rho, a non-parametric statistical test, was warranted to investigate the research questions and hypotheses (Field, 2009).

Population, Sample Size, Sample Frame, and Sampling Method Population

The population for this research was IT doctoral researchers in the United States. About 10 million professionals fit the target population (Bureau of Labor & Statistics (2012).

Sample Size

The target sample size, n, is expected to be at least 101 based on a sample power calculation with G*Power version 3.1.6. In calculating the sample size, a priori power analysis was performed to compute a sample size based on a given alpha, a given power, and given effect size values (Faul et al., 2012b). See Table 2 for the output of power calculation.

Table 2. *Output of Power Calculation*

Power Calculation
F tests – Linear multiple regression
Analysis: A priori: Compute required sample size
Input: Effect size f^2 =.15
α err prob = .05

Power (1-β err prob) = .95

Number of predictors = 4

Output: Total sample size = 101

Actual power = .0.9507039

Sample Frame

Doctoral researchers in IT with software project management experience from University of the Cumberlands formed the sample frame for this study. One hundred and twenty doctoral researchers participated in the survey. The demographics of the 120 doctoral students included software developers who work in small, medium, and large companies.

Sampling Method

The random selection of participants provided equal chances to all doctoral researchers in that database (Vogt, 2007). The strength of this sampling method was that it approximately represented the whole population thereby limiting the threat to validity or generalizability (Vogt, 2007).

A random sampling method was utilized in this study, with a 95% confidence level and a confidence interval of +/- 5%, which meets standard levels (Polit & Beck, 2004). A suitable sample size is one that has enough participants to be representative of a population, and has statistical power (Lowry, 2011). To determine the sample size that is representative of the population, one must know the population size, confidence interval and confidence level usually 95% (Vogt, 2007).

Recruiting participants involved sending out recruitment emails to doctoral researchers in IT with software project management experience who met the inclusion and exclusion criteria.

The recruitment message instructed potential participants to indicate their preference of participating in the study.

Instruments/Measures

This study used an original instrument design to investigate quantitative research approaches used in conducting research in software project management.

The final instrument was then constructed using a 5-point Likert scale with values ranging from 1 strongly disagree to 5 for strongly agree to collect the data. A total of 21 questions including biographical information constituted the measurement items on the instrument. The questionnaire items measured: liking quantitative research methods in software project management, and liking qualitative, quasi-experimental, and experimental quantitative methods.

Factor analysis that was performed showed most loadings occurring well above .50, which is considered a very acceptable factor loading. Generally, factor loadings ranged from 0.411 to 0.906.

Pilot Test

A pilot test was conducted to test the reliability and internal consistency of the instrument (Hertzog, 2008). Cronbach's alpha, a measure of instrument reliability (Cronbach, 1971), was computed to assess the scale reliability. All the Cronbach's alpha coefficients were greater than 0.70, indicating an adequate level of internal consistency. In other words, answers to a survey will be different due to differences in opinion not because the respondents have different interpretations of the survey or the survey is confusing (Cronbach, 1971; Hertzog, 2008). The results of ANOVA tests including the values of F-tests, levels of significance, and

values of the coefficient of determination indicated that the research model was robust and well-founded (Ali et al., 2008).

Data Collection

A survey was used to collect data for this study. According to Cooper and Schindler (2008), surveys are useful ways not only to determine the attitudes of people on questions but also to look for patterns of cause and effect among many variables. The survey, designed in the form of structured questionnaires was administered to 120 doctoral students at the University of Cumberlands, out of which 101 were completed and valid responses were received. The study used a random sampling method to select the 120 participants from the School. The random sampling method gives everyone an equal chance of being selected. The strength of this sampling method is that it approximately represents the whole population thereby limiting the threat to validity or generalizability.

The study participants were required to sign an informed consent form before they start. The participants were also required to complete the survey questionnaire, which was in hard copy distributed in class. The survey responses were inputted into a computer system and exported to IBM SPSS Statistics 20 software for statistical analysis. The data were copied and stored on a portable hard drive and encrypted with 256-bit Advanced Encryption Standard (AES) symmetric-key algorithm to ensure maximum protection and confidentiality.

Analysis and Interpretation

The data were filtered and exported to IBM' "Statistical Package for the Social Sciences" (SPSS) Grad Student version 20. Results that have partial, incomplete, or inconsistent data were rejected as items for analysis, while items that are valid and complete

were analyzed. The research instrument employed a five-point semantic differential Likert scale with values ranging from 1 Strongly Disagree to 5 for Strongly Agree.

Likert scales were used to measure the independent and dependent variables (Carifio & Perla, 2008; Norman, 2010). Likert type data is understood to involve an ordinal level of measure. Given ordinal level of measurement, a nonparametric statistical procedure - Spearman's rho was used for hypotheses testing (Carifio & Perla, 2008; Creswell, 2008; Field, 2009; Norman, 2010).

Furthermore, the data were prepared, screened for normality with skewness and kurtosis statistics. Five out of seven distributions had significant negative skews, and six out of seven distributions were outside the range of normality for kurtosis. Since most of the distributions had significant negative skews and were outside the range of normality, the use of Spearman's rho, a nonparametric statistical test, was warranted to investigate the research questions and hypotheses (Field, 2009).

This study is a comparative analysis of the quantitative research approaches used to conduct studies on software project management. The purpose is to find out the quantitative research approaches preferably used to conduct studies on software project management. It is also within the goal of this study to find out the impact of sampling, validity, reliability, and bias on these methods of research. Specifically, the study correlated scores associated with the independent variables namely quantitative research methods and the dependent variables of software project management.

Research Question Testing

The research question and hypothesis tested showed that many IT and software project management studies were done with quantitative methodology (Gokaydin, 2007). Korrapati

and Eedara (2010). The type of quantitative approaches used include qualitative and quasi-experimental. Although not a testable hypothesis, the study found from literature review that software project research areas include finding out the relationship between software project success and Information Technology (IT) employee job satisfaction in IT companies. Gokaydin (2007) used the quantitative approach to study the outcome of projects managed by certified Project Management Professionals (PMP) and compares the project outcomes to noncertified project managers. Norri and Walker (2004) use mixed method comparison survey, which includes a quantitative analysis utilizing ANOVA that demonstrated the statistical significance to study project management leadership.

Bias

Bias in research refers to a misrepresentation or alteration of the findings directly or indirectly by the researcher (Cooper & Schindler, 2008). There are two possible sources of bias: the effects of the researcher on the case, and the effects of the case on the researcher (Cooper & Schindler, 2008). Researcher effects, the first form of bias are when the researcher disrupts or threatens social and or institutional relationships (Cooper & Schindler, 2008). This has become one of the most challenging research biases to avoid in many quantitative studies when relying upon interviews.

The second form of bias is when participants tell the researcher what the researcher wants to hear or what is politically correct. The way to address this is to spell out the intentions of the research to the participants. This includes advising the participants about the purpose of the research, why the interviews are taking place, and how they would collect and use the information. Executives will be able to choose the location of the interview to remove the

threat quotient and perception of exoticism (Cooper & Schindler, 2008). This study did not involve any interview and was free of any bias.

Conclusion

Despite the improvement in project management processes and project manager certifications, there are still many software projects that are not successful (Debbie, Timothy, & Mark, 2007; Maizlish & Handler, 2007; Standish Group, 2004). According to the Standish Group (2004), 71% of software projects failed. Researchers thus, began to study causes of failure of software projects, and ways to increase the success rate of software projects (Maizlish & Handler, 2007).

As a result, researchers tend to use the quantitative approach most frequently in software project research (Gokaydin, 2007; Korrapati & Eedara, 2010; Lindbergh, 2009; Norri & Walker, 2004). Descriptive and quasi-experimental researches are the quantitative approaches that researchers use mostly in software project research (Gokaydin, 2007; Lindbergh, 2009). Part of it is that these quantitative approaches tend to be objective, deductive, and generalizable (Benetti, et al., 2009). The experimental approach, which is the other major quantitative research approach, requires the use of controlled groups, which is more appropriate to studies in medicine and nursing (Howe, 1998; Morse, 1991). The issues of sampling, validity, reliability, and bias are crucial in any empirical study.

Quantitative designs tend to meet the test of validity, reliability, and bias better than any other research designs (Benetti, et al., 2009). The analysis in this response shows that reliability is equally as important as validity. A study technically is of no use if it does not lead to generalization (Benetti, et al., 2009).

Recommendation and Implication for Further Research

Although, it may cost more money, time, and effort, it is simply important to choose a sample size that will be able to accomplish reliability and generalizability. This is akin to the popular adage that anything worth doing is worth doing well. There is the tendency for researcher's bias to influence the output of research studies (Miles & Huberman, 1994). Gladly, it is possible to clarify researcher's bias through Moustakas' (1994) epoch process. All being said and done, it is important to remember that, the quality of a research does not only depend on the adequacy of its planning, but also on the productivity of the measurement processes that are used (Benetti, et al., 2009).

This study did not look at all the methods of software development. Therefore, we could not generalize the finding of this study to all types of software project management. This could be areas for further research. This study focused on quantitative approaches that are associated with software management projects precluding all other types of research methodologies.

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