

Triangulating Statistical Power Analysis with Reflective Analysis in Management Research

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Abstract—Whatever research classifications are combined for implementation; such as, classifications according to PURPOSE, METHOD, and APPLICATION, the format must contain the following within a combination of quantitative and qualitative approaches: an Introductory section, Research procedures, Research Outcomes, Conclusions and Recommendations.

Keywords—Research Purpose according to Purpose, Method, and Application, Quantitative research, Qualitative research, Statistical Power Analysis, Reflective Analysis

I. INTRODUCTION

Research designs are plans that guide the following:

- a) Data collection by specifying the following:
 - i) Type of information to collect,
 - ii) The sources of data, and
 - iii) The data collection procedure

So as to assure the following:

-that the information gathered is consistent with the study objectives;

-that the data are collected by accurate and economical procedures

- b) Analysis

II. MAIN BODY

I. What are the contents of researches, classified according to purpose or where the researcher may find himself/herself to be situated among the three stages in the decision-making process; namely:

- a) Exploration of dependent and independent variables,
- b) Establishing conclusions based on the explored variables, and
- c) performance-monitoring of the dependent variable using the explanatory independent variables?

Researches can be classified according to Purpose or Stage in the Decision-Making Process; it is claimed that the

research purpose or stage in the decision-making process, determines the characteristics desired in the research design [9]. If we may repeat, research purposes --it is claimed-- depend on the phases of the decision-making process for which information is needed and accordingly yields three types of research designs; namely:

- a) Exploratory,
- b) Conclusive,
- c) Performance-monitoring research design.

A. Exploratory research design

The central purpose is to formulate hypotheses regarding potential problems and opportunities present in the decision situation. The hypotheses can be tested at a later phase with a conclusive research design [6].

Exploratory research design applies when the research objectives include the following:

- a. identifying problems (threats or opportunities)
- b. developing a more precise formulation of a vaguely identified problem(threat or opportunity)
- c. gaining perspective regarding the breath of variables operating in a situation
- d. establishing priorities regarding the potential significance of various problems (threats or opportunities)
- e. gaining management and researcher perspective concerning the character of the problem situation
- f. identifying and formulating alternative courses of action; and
- g. gathering information on the problems associated with doing conclusive research.
- h. identification of problems (threats or opportunities) can be assisted through the following:
 - i) Searching secondary sources,
 - ii) Interviewing knowledgeable persons,
 - iii) Compiling case histories

B. Conclusive research design

Provides information for the evaluation of alternative courses of action .The sub-classifications of conclusive research design follows [10]:

a. descriptive research

- i) Cross-sectional design –takes a sample of the population at one point in time
- ii) Longitudinal design –describes changes in a sample’s characteristic over a period of time

b. causal research

Descriptive research relies heavily on interview of respondents and data available in secondary data sources. Descriptive research is proper when the research objectives include the following:

- i) Portraying the characteristics of a social or physical phenomena and determining the frequency of occurrence
- ii) Determining the degree to which the variables are associated (however, cause-and-effect relationships, discussed under causal research design, are different from measurements of degrees of association in descriptive research design)
- iii) Making predictions regarding the occurrence of social or physical phenomena.

Causal research relies on interviews and in the conduct of experiments. Causal research is proper when the research objective is to identify variables that cause the phenomenon being predicted and understand why they cause what is being predicted. A suspected variable that predicts an identified phenomenon must be freed of other variables that pollute it by doing either one of the following:

- i) avoid the influence of time that tends to combine other factors with the suspected variable as it influences the phenomenon being predicted by using a cross-sectional design that gathers data as of a point in time (so as to "purify" a specific explanatory variable of accretions arising from the passage of time);
- ii) if a longitudinal data cannot be avoided, at least achieve stability and hence predictability in the relationship between the suspected explanatory variable and the phenomenon to be predicted by invoking the law of large numbers which asserts that regardless of the distribution of the population among the values of the suspected explanatory variable, the mean of the sampling means tends towards a normal distribution. The mean of a normal distribution equals the mean of a student-t distribution; hence, what is important here, is it reduces finding the partners-in-a-description of a population (the mean and the standard deviation) by looking for its margin-of-error only (since the mean is already given) through the statement of the researcher regarding his/her desired confidence level and desired margin-of-error in determining the desired sample size given the following equation [3],

$$\text{Desired sample size "n"} = \frac{s^2 z^2}{e^2}$$

Where:

s –the standard error of the pilot sample arbitrarily chosen by the researcher, when there is no standard deviation given in a census of the population

z –the equivalent in a standardized rendition of a normal distribution, of the confidence level desired by the researcher

e –the desired margin-of-error from the true mean

Please note that the standard error of the pilot sample is essential in this computation.

The inability to avoid the influence of time as it pollutes an explanatory variable such as in longitudinal data can be remedied by invoking the law of large numbers.

Another inability to avoid the influence of another factor on the dependent variable, hidden in the explicit explanatory variable, even in cross-section data can be minimized by also invoking the law of large numbers.

Post Test-Only Control Group Design [7]. The Solomon Four-Group Design controls the inability to avoid the influence of another factor on the dependent variable, hidden in the explicit explanatory variable, even in cross-section data.

Unfortunately, time, effort, and cost necessary in conducting the experiment outweighs the benefits particularly the time involved so that by the time the results are out, time has introduced changes in the alleged "pure" explanatory factors.

A smaller design was needed for a relatively faster turn out of results before time takes it toll on an allegedly "pure" explanatory variable. And such a design is the Posttest-Only Control Group Design as follows:

Experimental group: R X O₁
Control group : R O₂

Where:

R –indicates that individuals have been assigned at random to separate treatment groups (random selection) or that groups themselves have been allocated at random to separate treatments (random assignment).

X –represents the exposure of a test group to an experimental treatment, the effects of which are to be determined.

O –refers to processes of observation or measurement of the dependent variable on the test units.

Here the O₁ and the O₂ measurements are composed of the following:

$$O_1 = TE + EXT$$

$$O_2 = EXT$$

Where:

TE –treatment effect

EXT-effect of extraneous variables

Therefore: O₁ - O₂ = TE + EXT – EXT = TE

There is no pretest in the design which avoids the interactive effect or the influence of another factor on the dependent variable, hidden in the explicit explanatory variable due to the passage of time.

Further, it avoids the influence of another factor on the dependent variable, hidden in the explicit explanatory variable, even in cross-section data.

But two critical assumptions have to be made, based on the drawing of large enough samples and proper randomization, as follows:

a) The random assignment of test units to the groups has resulted in the groups being approximately equal on the dependent variable before the presentation of the treatment to the experimental group.

b) The test units withdrawing from the experiment while it is in progress affect each group in the same way.

C. Performance-monitoring research design is an essential element in the control of programs in accordance with plans. The purpose of the design is to achieve an early warning system to predict potential threats or opportunities [11]. The objectives of Performance-Monitoring Research Designs in monitoring and reporting changes follow:

a) In performance measures, to determine whether plans are accomplishing desired objectives

b) In situational variables in the environment, to determine whether the situational climate is as anticipated when plans were formulated.

The sources of data that is proper for Performance-Monitoring Research Designs follows:

a) Interview of respondents, b) Secondary data, c) Observation.

A fine example of a Performance-Monitoring approach incorporates Bayesian probability figures such as in the following manner of making a future choice between say, two products; such as, product “a” and product “b”, as shown below :

				EMV*
product “a”	when successful yields a profit of \$100/piece	Probability of occurrence: 10%		\$10/pc
	when unsuccessful yields a loss of \$50/piece	Probability of occurrence: 90%		<u>-\$45/pc</u>
		NEMV**		-\$35/pc
product “b”	when successful yields a profit of \$100/piece	Probability of occurrence: 5%		\$5/pc
	when unsuccessful yields a loss of \$10/piece	Probability of occurrence: 95%		<u>-\$9.50/pc</u>
		NEMV**		-\$4.50/pc

Given no other choice on products to produce and sell except products “a” and “b”, the product which would give a lesser expected monetary loss will be the one chosen which in this instant case is product “b” .

* Expected Monetary Value

** Net Expected Monetary Value

II. For the research classifications according to the following:

a) PURPOSE; namely: exploratory, conclusive, and performance monitoring researches; and

b) METHOD of data collection-and-analysis can either be any of the following depending on their availability in addressing the research questions:

i. Quantitative

ii. Qualitative

iii. A combination of Quantitative and Qualitative methods with the following parts:

I) Introductory section

II) Research Procedure

III) Research Outcomes:

a. Discussion of results in Qualitative research

b. Analysis, Interpretation, Conclusions and Recommendations in Quantitative research

IV) Conclusions and recommendation; the third question is on their APPLICATION.

III. What are the possible APPLICATIONS of the two research classifications; namely: according to PURPOSE and METHOD in the following disciplines?

a) Education, Arts, Sciences and

b) Management (Business Administration and Public Administration)

The research classifications, according to the following --a. three decision-making phases, of exploratory, conclusive, and performance-monitoring researches (please see the preceding Classification of Researches, according to PURPOSE, in question no. I.), b. method of data collection-and-analysis (please see the preceding Classification of Researches, according to METHOD, in question no. II.)--are executed in one or three of the following kinds of APPLICATIONS. Please see articulation in the paragraph following item no. III. Below [12]:

i) action research, ii) evaluation research, iii) dissertation/thesis writing

A) Action research in Management:

ACTION RESEARCH GUIDELINES, Though CHED Memo Circular # 53, series of 2007, applies the conduct of Action Research particularly for the Masters of Education in (professional area), it can be a semester’s requirement for the Management courses as well.

Action Research is “a form of applied research whose primary purpose is to increase the quality, impact, and justice of...professional’s practice.” [4]:

1. Provide the personal, professional, and political purposes you want the project to serve in designing an action research project.

2. Determine the best research design methods in answering the research question/s according to purpose, such as exploratory, conclusive, and performance-monitoring research designs [5].

B) Evaluation Research [8]:

Another possible application in Management of the three research designs of exploratory, conclusive, and performance monitoring research design is in Evaluation Research. Considerations for effective evaluation follows:

Utility—the extent to which the evaluation is informative, timely, and useful to the affected persons.

Feasibility –the extent to which the evaluation design satisfies the following:

a) Appropriate to the setting in which the study is to be conducted, b) Cost - Effective.

Propriety –the extent to which the evaluation is conducted legally and ethically.

Accuracy –the extent to which the evaluation produces judgements of the evaluated program’s worth which satisfies the following:

a) valid, b) reliable, and c) comprehensive.

The following questions capture the considerations for effective evaluation:

- i) How great is the need for the product?
- ii) How large and important is the market for the product?
- iii) How generalizable are the results of field tests of the product?
- iv) Did the field tests result in good data samples of all relevant user groups?
- v) How thorough was the cost analysis for the product?
- vi) Were side-effects of the product diligently sought?
- vii) Were side-effects of the product diligently sought?
- viii) Were any of the standards in the following which were relevant during the product development process applied:
 - a) ethical, b) professional and c) research?
- ix) Was the research design used in the field trial sufficiently rigorous to determine that the product was the actual cause of any observed effects?
- x) How rigorous was the comparison between the product and its competitors?
- xi) How appropriate were the statistical analyses of field-test results? And if statistical significance tests were done, did they yield significant results?
- xii) How great is the significance of the product in relevant disciplines?

C) Dissertation / Thesis research

The last but not the least application in Education, Arts, Sciences, and Management of the three research designs of exploratory, conclusive, and performance monitoring research design is in Dissertation/thesis research writing.

The basic difference between a dissertation and a thesis is in their purposes.

A dissertation pushes the frontiers of knowledge while a thesis either reconfirms or invalidates a prior research conclusion.

III. CONCLUSION

Whatever research classifications are combined for implementation; such as, classifications according to PURPOSE, METHOD, and APPLICATION, the format below has to be followed: an Introductory section, Research procedures, Research Outcomes, Conclusions and Recommendations:

Introductory section

1) The researcher explains his/her experience, orientation, and expectations relevant to the problem being investigated and indicates how these factors might affect the results;

2) Given the contextual background, the research must be carried out currently in a real-life setting;

3) Determine whether any research traditions shall be used as a basis for the study, and if so, they should be used appropriately in the definition of the research problem and in the collection, analysis, and interpretation of the data;

Research procedures

1) Specify a preliminary plan for the study and be ready to modify the plan as needed in response to analysis of data early in the study;

2) Use a random sampling strategy to select participants to the research question and the definition of the phenomenon of interest but be ready to shift to purposeful sampling when respondents do not appear for interview despite repeated attempts to reach them; this shift in sampling procedure will change the generalizing procedure from deduction (starts with a theoretical or conceptual guideline in collecting particular data to prove the validity of the theory) to induction(from particular cases towards the derivation of a general pattern or theory of social behaviour).

3) Use the data-collection method/s suitable to the intended purpose (such as either through interview, or through observation, or through secondary-data collection from documents);

4) Allow sufficient time-frame for data collection so that an in-depth study of the research question can be made;

5) Use strategies that will ensure consistency across observers or other data collectors that would demonstrate agreement among observers in their observations; particularly the fit between the data and what occurs in the setting under study.

6) Use quantitative data, if it can be obtained, whenever appropriate to understanding the research problem or question; specially when the quantitative comments as to expected research findings are identified by catch phrases or words, such as “more than”, “significant”, “extremely”, “not very much”, etc.

7) Examine whether quantitative measures can be used to document the preceding catch phrases or words in terms of data that indicate means, standard deviations, correlations, and predictability coming from regression;

8) See to it that various data-collection methods or sources of data are used and compared to confirm or clarify the key findings of the study;

Research Outcomes

In this section, a discussion of the following should include:

1) Discussion of results in Qualitative research, guided by the following:

a) See to it that the written report makes clear each research procedure used and the order in which they occurred so that it would be possible for other researchers to replicate the study;

b) See to it that the written report includes sufficient quotations or summary comments from the research participants/respondents in order to clarify (emic) their perspective

c) Check the findings with members before finalizing the written report;

d) Check whether you, as the researcher, have summarized your personal reaction to the findings or have compared (etic) your perspective on the phenomenon studied to those of research participants or respondents;

2) Research results in Quantitative research, which contains ways to:

-Identify how you interpreted the findings and whether you considered alternative interpretations;

Conclusions and Recommendations

This section should contain a discussion on the type of research selected, guided by the following:

1. Qualitative research may end-up with no conclusion as to an emergent theory when the observation of the participants do not harmonize with those of the researcher [the emic and the etic are irreconcilable] [1]

2. In Quantitative research, pay attention to the following:

a) Conclusions are supported by the data and its statistical power analysis;

b) Determine how the research findings can be applied to other settings or types of research participants/respondents; and give justification for said extension;

c) Draw reasonable implications for practice and future research and see whether such implications are justified by the research findings.

3. In Qualitative research, include a reflective analysis of the action research process via autobiographical narrative/s or journaling by making a personal ongoing written record as the researcher regarding a specific domain that could be broad and open-ended or on a specific topic.

4. Apply Gary Anderson and Kathryn Herr's validity tests as follows [2]:

a) Outcome validity test -extent to which new actions lead to a resolution of the problem that prompted the project;

b) Process validity test -the adequacy of the processes used in different phases of the project so as to protect the findings from bias such as in data collection, analysis, and interpretation; and also whether triangulation of data sources and methods were used so that corroborative evidence for the validity of the qualitative research findings are obtained from a multiplicity of the following:

- i) data-collection methods,
- ii) data sources,
- iii) analysts, or
- iv) theories.

c) Democratic validity test -the extent to which the perspectives and interests of all stakeholders were taken into account;

d) Catalytic validity test -the extent to which the project causes stakeholders to transform their view of reality in relation to their professional practice;

e) Dialogic validity test -the extent to which colleagues shared in the development of the practitioner/researcher's findings and interpretations.

5. Continue or modify the action research project depending on the results of action taken based on the earlier results or findings of the research project.

6. Reduce the discrepancy between the practitioner-researchers' espoused theories or "the professionals" beliefs about how they deal with problems of practice" and theories-in-action or "the actual behaviour of professionals as they engage in their work".

7. Suggest strategies for dealing with the unique ethical issues in action research such as the extent of knowledge of participants' knowledge of the consequential risks involved on their lives of the research project --either in processes involved or the resulting findings or in both.

8. Help other researchers determine to what extent your findings fit their situation by properly designing and reporting the results of the action research.

IV. RECOMMENDATION

As can be gleaned from the preceding discussions, an appropriate format must contain elements of both quantitative and qualitative methods for purposes of better triangulation following any of the below-listed fourth typology of Management Studies resulting from the convergence of the three classifications of PURPOSE, METHOD, and APPLICATION:

- i) Experimental Research
- ii) Causal-Comparative Research
- iii) Case study
- iv) Content analysis
- v) Correlational Research
- vi) Historical Research

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