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Validity, Reliability and Triangulation in Case Study Method: An Experience

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Abstract

This article discusses the use of reliability and validity in the qualitative research paradigm specifically in case study method. First, reliability, validity and triangulation as used in case study method are discussed as a way of providing a springboard to examining what these three terms mean. Secondly, the process of validity and reliability in case study method are discussed and how they can be employed in the qualitative research paradigm. This paper concludes by drawing upon the use of triangulation in the two activities (data collection and case study process) to show how the adoption have influenced our understanding of reliability, validity and triangulation in qualitative studies.

Keywords: Validity, reliability, triangulation, case study

1. INTRODUCTION

"Validity" and "Reliability" term has always probe a big question mark for qualitative researcher. The consistency, genuineness and trustworthiness of data in research has been queried in order to reflect the multiple ways of establishing truth. Therefore, the credibility of a qualitative research depends on the; i) validity and reliability of research findings while designing a study, analyzing results and judging the quality of the study (Patton, 2001); ii) how far research findings of an inquiry are worth paying attention to the audience (Lincoln & Guba, 1985); iii) the quality of a study in each paradigm should be judged by its own paradigm's terms for example 'credibility', 'neutrality' or 'confirmability', 'consistency' or 'dependability' and 'applicability' or 'transferability' (Lincoln & Guba, 1985); iv) three principles of data collection were employed to make sure that the data collected were reliable and valid, hence lending credibility to the case study such as: (a) multiple sources of data/evidence; (b) creating a database; and (c) maintaining a chain of evidence (Yin, 2009); v) whether the researcher have fulfilling the 'rigor and thoroughness' requirements in case study process on (a) construct validity, (b) internal validity, (c) external validity and (d) reliability (Yin, 1994); vi) ability and effort of the researcher (Golafshani, 2003) as the primary 'instrument' in research (Merriam, 1988 and Patton, 2001) and vii) triangulation as strategy (test) for enhancing the validity and reliability of research or assessment of results (Mathison (1988) where researchers 'seeks for convergence among numerous and distinct sources of information to form themes or categories in a study" (Creswell & Miller, 2000, p. 126). In all, the purpose of this study is to share the researcher experience on validity and reliability in case study method and how triangulation has increase the trustworthiness and dependability of research findings.

2. LITERATURE REVIEW

2.1 What is case study research?

Case study research is defined as "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context is not clearly evident" (Yin 2009, p. 18). Anderson (1993) sees case studies as being concerned with how and why things happen, allowing the investigation of contextual realities and the differences between what was planned and what

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actually occurred. Case study is not intended as a study of the entire organization. Rather is intended to focus on a particular issue, feature or unit of analysis. In order to understand and examine the processes of training activities in organizations, case study method was chosen. This method enables me to understand the complex real-life activities in which multiple sources of evidence were used. The used of case study to probe an area of interest in depth is particularly appropriate as described by Patton (1987), that case studies become particularly useful where one needs to understand some particular problem or situation in great-depth, and where one can identify cases rich in information.

2.2 Reliability and validity in case study research

Although the term 'Reliability' is a concept used for testing or evaluating quantitative research, the idea is most often used in all kinds of research. The most important test/strategy of any qualitative study is its quality. A good qualitative study can help us "understand a situation that would otherwise be enigmatic or confusing" (Eisner, 1991, p. 58).

On the other hand, Patton (2001) states that validity and reliability are two factors which any qualitative researcher should be concerned about while designing a study, analyzing results and judging the quality of the study. This corresponds to the question that "How can an inquirer persuade his or her audiences that the research findings of an inquiry are worth paying attention to?" (Lincoln & Guba, 1985, p. 290). To answer to the question, Healy and Perry (2000) assert that the quality of a study in each paradigm should be judged by its own paradigm's terms. For example, while the terms Reliability and Validity are essential criterion for quality in quantitative paradigms, in qualitative paradigms the terms Credibility, Neutrality or Confirmability, Consistency or Dependability and Applicability or Transferability are to be the essential criteria for quality (Lincoln & Guba, 1985).

The concept of validity is described by a wide range of terms in qualitative studies. This concept is not a single, fixed or universal concept, but "rather a contingent construct, inescapably grounded in the processes and intentions of particular research methodologies and projects" (Winter, 2000, p.1). Additionally, Lincoln and Guba (1985) states that: "Since there can be no validity without reliability, a demonstration of the former [validity] is sufficient to establish the latter [reliability;]" (p. 316). Patton (2001) with regards to the researcher's ability and skill in any qualitative research also states that reliability is a consequence of the validity in a study.

Yin (2009) proposed three (3) principles of data collection to deal with the problems of establishing the construct validity and reliability of the case study evidence which are; (1) multiple sources of evidence; (2) create a case study database; and (3) maintain a chain of evidence. With regards to rigour and thoroughness in case study process, the elements of construct validity, internal validity, external validity and reliability is the strategy used to enhance the validity and reliability issue (Yin, 1994, 2009, 2012).

2.3 Triangulation in case study

Triangulation is defined to be "a validity procedure where researchers search for convergence among multiple and different sources of information to form themes or categories in a study" (Creswell & Miller, 2000, p. 126). Triangulation is typically a strategy (test) for improving the validity and reliability of research or evaluation of findings. Mathison (1988) elaborates this by saying: 'Triangulation has risen an important methodological issue in naturalistic and qualitative approaches to evaluation [in order to] control bias and establishing valid propositions because traditional scientific techniques are incompatible with this alternate epistemology' (p. 13).

Engaging multiple methods, such as, observation, interviews and documents review (Yin, 1994, 2009) will lead to more valid, reliable and diverse construction of realities. To improve the analysis and understanding of construction of others, triangulation is a step taken by researchers to involve several investigators or peer researchers' interpretation of the data at different time or location. In a related way, a qualitative researcher can "use investigator triangulation and consider the ideas and explanations generated by additional researchers studying the research participants" (Johnson, 1997, p.284).

Triangulation may include multiple methods of data collection and data analysis, but does not suggest a fix method for all the researches. The methods chosen in triangulation to test the validity and reliability of a study depend on the criterion of the research (Golafshani, 2003). Patton (2002) discusses four types of triangulations in doing evaluations, data triangulation, investigator triangulation, theory triangulation and methodological triangulation.

Yin (2009) advocates that triangulation in case study method have a major strength for example, the researcher have the opportunity to use many different sources of evidence in data collection. Furthermore, the need to use multiple sources of evidence far exceeds that in other research methods, such as experiments, surveys, or histories.

3. METHOD

A single case study was conducted in one of the leading petrochemical companies in Malaysia. A pseudonym is used to describe the company, which is referred to as 'Company A'. The company is a petrochemical plant in nature. Company A and group-wide established a big conglomerate of chemical producer in Malaysia. The business activities include (i) the exploration, development and production of the refining and marketing of petroleum products; (ii) the manufacture and sale of petrochemical products; (iii) the trading of crude oil, natural gas, LNG, petroleum products and petrochemical products; and (iv) shipping and logistics relating to LNG, crude oil and petroleum products. As the leading integrated chemical producer in Malaysia with a total combined production capacity of over 10 million metric tons per annum (mtpa), Company A and the group-wide entity involve primarily in manufacturing, marketing and selling a diversified range of chemical products, including ammonia commercially, as well as supplying carbon monoxide (CO) and oxogas (a mixture of hydrogen and CO), olefins, polymers, fertilizers, methanol and other basic chemicals and derivative products.

Company A was chosen as a case to be studied in the present research for five reasons, discussed below:

(i) First, a single case can contribute significantly contribution to knowledge and theory building (the study was conducted on how company A implemented its corporate social responsibility (CSR) towards environmental protection in Malaysia).

(ii) Secondly, Company A was chosen because the case represented an extreme or unique case. Problem solving will only be found by investigating a single case study. This was achieved by examining the CSR green practices through EMS ISO14001 in Company A, which could not be possible if the study were to be conducted in any type of company.

(iii) Thirdly, a single case study was employed in Company A because it was 'representative' of a 'typical case'. Company A is one of the big conglomerates of 25 chemical companies in Malaysia. Therefore, as mentioned by Yin (2009), Company A was 'representative' of a 'typical case'. Thus, the everyday circumstances in Company A and group-wide entity could be said to be similar. Additionally, a manufacturing firm is typical of other manufacturing firms within the same industry. A chemical company that produces Ammonia, Carbon dioxide and Oxogas has therefore similar manufacturing activities.

(iv) Fourthly, the single case was conducted in Company A because it was a revelatory case. This situation existed when the researcher had an opportunity to observe and analyze a phenomenon previously inaccessible to scientific observation. The case study was therefore worth conducting because the "first hand" information would be revelatory.

(v) Lastly, a single case involves a "prolonged engagement and persistent observation in the field" (Creswell, 2007). During data collection process, the researcher managed to be engaged in field and made observation by doing the following: building trust with participants, learning the organizational culture in Company A, checking for misinformation that could stem from distortions introduced by the researcher and informants, and making decision about what was salient to the study, relevant to the purpose of the study and of interest.

4. FINDINGS

Validity and reliability of research findings has been met through triangulation procedure in the study. According to Yin (1994), as in all research, consideration must be given to construct validity, internal validity, external validity, and reliability. He suggested using multiple sources of evidence as the way to ensure construct validity (i.e., the study used multiple sources of evidence; survey instruments, interviews, and documents). In this article, the researcher share her experience on validity and reliability of case study method based on recommendation by Yin (1994).

The study shows that the trustworthiness and accountability of findings was achieved over; (i) data collection stage and (ii) throughout case study process.

4.1 Validity and reliability of data: Data collection activity

Three principles of data collection were employed to make sure that the data collected were reliable and valid, hence lending credibility to the case study. They are: (a) multiple sources of data/evidence; (b) creating a database; and (c) maintaining a chain of evidence (Yin, 2009).

Firstly, the researcher used **multiple sources of data** to converge the findings. The sources of data in this study were Company A's 'internal documents' such as the Environmental Impact and Aspect procedure, Hazardous Spillage Management, and HSE communication procedure1, which were later triangulated with interviews with key informants and direct observations. The use of multiple sources of data in this study allowed the researcher to address a broader range of CSR practices in Company A (i.e. the data revealed two types of CSR practices in Company A: philanthropy orientation on societal needs and biodiversity concern, and internal CSR on EMS ISO14001 green practice). With the use of multiple sources, the researcher was able to explore the transformation of CSR practices in Company A from the philanthropy motive to the EP objective which was being practiced simultaneously. In short, through the use of multiple sources of data, a line of inquiry was converged. The process of triangulation where data from documents, interviews and direct observation were corroborated enhanced the validity and credibility of the findings obtained. With data triangulation, the potential problem of construct validity was addressed because the multiple sources of evidence essentially provided multiple measures of the same phenomenon.

Secondly, **a case study database** assisted the researcher in organizing and documenting the data collected. A case study database represents a formal assembly of evidence distinct from the final case study report (Yin, 2009). This was done by separating the following documents: data gathered from Company A, and the personal notes/report of the researcher (i.e. in article, report or book form). These documents were stored in different places to distinguish them from each other. For example, the data from Company A (i.e. environmental monitoring procedure and schedule waste management documents) were placed in box 1 and the report of the researcher in box 2 (i.e. refer to the secondary analysis conducted by the researcher). Such documentation was to develop a formal, presentable database for review by other researchers/investigators, if needed. In this sense, a case study database increased the reliability of the entire case study.

Lastly, **a chain of evidence** was employed to achieve reliability of the case study. A chain of evidence explicitly links among the questions asked, the data collected, and the conclusions drawn. The steps conducted in this study were as follows:

i) The researcher referred to specific documents in Company A (i.e. Environmental monitoring and HSE communication procedure), conducted interviews with key informants no 1, no 2 and no 3, and made field observations in Company A's chemical plant;

ii) The database stored the empirical evidence (i.e., first hand's information on environmental initiatives by key informant 1, key informant 2 and key informant 3) and indicated the circumstances under which the evidence was collected.

iii) The previous circumstances mentioned in this study were consistent with the specific procedures and questions contains in the case study protocol to show that the data collection had followed the procedures stipulated by the protocol (i.e., through triangulation over interviews, documents review and observations at company A).

iv) Finally, a reading of protocol indicated the link between the content of the protocol and the initial study questions (represented in research questions on; (1) What is the current CSR practices related to environmental protection? and (2) How CSR practices are integrated in the EMS ISO14001 in regards to environmental protection? Therefore, the cross-referencing in the methods and techniques was to ascertain construct validity and reliability of the case study findings.

4.2 Rigour and thoroughness in case study process

Rigor and thoroughness was met by the following procedure: (a) validation and confirmation by key informant no 1, no 2, and no 3 in Company A. The early conceptual framework established was sufficient to explain Company A's environmental protection objective; (b) certification by SIRIM Berhad on EMS ISO14001 in Company A; and (3) verification letter by DOE Malaysia on Company A's lawful conduct. To validate and ascertain the reliability of the study, four tests were used (Yin, 2009). The tests/ strategy are explained below:

Table 1: Rigor and thoroughness in case study process: Validation, reliability and triangulation

Tests/ Strategy	**Case study tactics**	**Triangulation procedure**
1) Construct validity - The researcher identified correct operational measures of the concepts studied i.e., based on; (1) preliminary study and (2) the proposed conceptual framework by Husted (2000) and Gandhi et al (2006).	- The researcher used multiple sources of data by triangulating data from interviews, document reviews, direct observation and participant observation. - The researcher established chain of evidence (i.e., presented the evolution of CSR practice in Company A from previous philanthropy motive to contemporary green practice objective). - Have key informant reviewed the draft of case study report (i.e., in this case, key informant no 1 reviewed the report on data analysis during data collection).	✓ Data collection ✓ Data collection ✓ Member's checking
2) Internal validity - Establish an association between variables/ determinants. This because this study had mapped the research design with the conceptual framework based on previous works (Husted, 2000; Gandhi et al., 2006).	- Do pattern matching (i.e. comparing an empirically based pattern with the predicted one. If the patterns coincide, the results can help strengthen the internal validity of the case study. - For instance, the researcher added a new variable (corporate reputation as one of the forces of environmental protection objective) during the preliminary study. - Another example, she predicted a pattern of specific variables prior to data collection (i.e. decision making and information flow began from EMS ISO14001, not from the company's structure as proposed in the previous conceptual framework).	✓ Data analysis
3) External validity - Define external validity, which refers to the recognition from the policy maker, namely, SIRIM QAS International and the Department of Environment Malaysia.	- To validate and confirm the findings on environmental protection by Company A, certification and recognition was given by SIRIM QAS International and DOE Malaysia for approval of Company A lawful conduct towards environmental protection.	✓ Research design
4) Reliability - Demonstrate that the study can be replicated in terms of data collection with the same results obtained.	- Use a case study protocol from multiple sources of data from interviews, documents and observation. - Develop a case study database (chain of evidence so that the audience understands the flow of events in the case study reporting). - The goal of reliability is to minimize errors and biases in a study.	✓ Data collection ✓ Data collection

Source: Adopted by Case Study Research: Design and Methods, 4th edition, Robert K.Yin, 2009

5. DISCUSSION

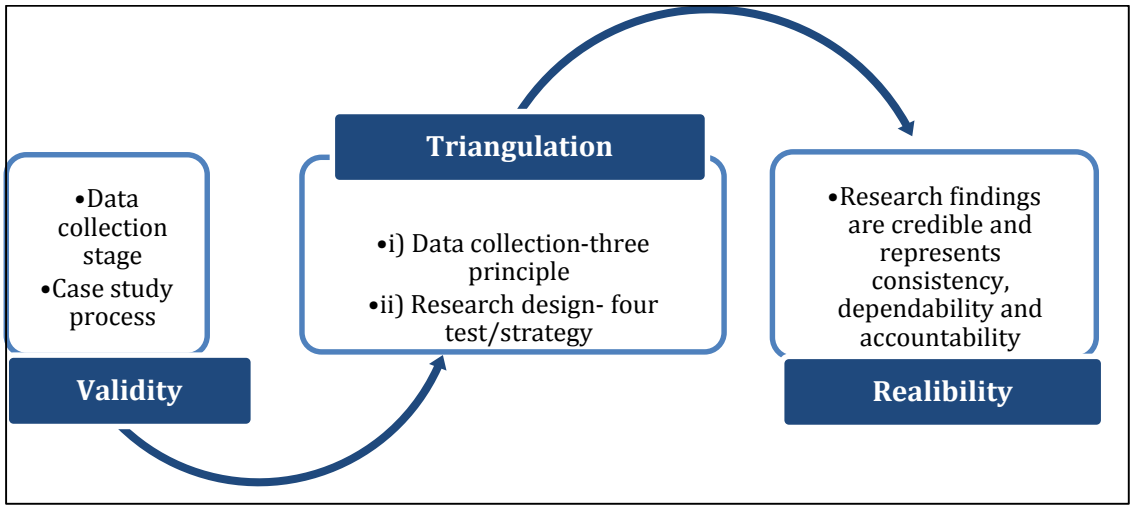

Figure 1: Validity and reliability in case study method through triangulation procedure

A holistic approach on validity and reliability through triangulation procedure have increase the trustworthiness and dependability of research. In this study the researcher adopts validity and reliability procedure to achieve quality and credible research findings. As describe by figure 1, validity process can be seen in two levels whereby they were represented during (i) data collection at company A i.e, a) using multiple sources of data/evidence; b) creating a database; and c) maintaining a chain of evidence (Yin, 2009); and (ii) rigour and thoroughness of case study process in research (i.e, test on construct validity, internal validity, external validity and reliability). The validity protocol as proposed by Yin (2009) has been followed by the researcher so no issue of validity occurred.

Scholars has defined validity as a result the reliability of a qualitative study (Lincoln & Guba, 1985; Patton, 2001). Therefore by adopting these two terms, triangulation has increased the credibility of findings. This is proven when the researcher has employed triangulation procedure; (i) during data collection process (i.e, over interviews with key informant 1, key informant 2 and key informant 3 at company A, documents reviewed-company A documents, annual report, and sustainability reports and observations at company A chemical plants and administration office). Therefore, the researcher realized that a major strength of case study data collection is the opportunity to use many different source of evidence. This is proven when the researcher has an opportunity to emerge the multiple source of evidence into the development of converging lines of inquiry technique. As mentioned by Yin (1994, 2009), the converging lines of inquiry is a "process of triangulation and corroboration emphasized repeatedly" (page 116) so that, any case study findings or conclusion is likely to be more convincing and accurate based on several different sources of information, following a corroboratory mode. For example, the researcher triangulated the data of the case study (i.e., interviews, document reviews and observations) and corroborated them at the same fact or phenomenon. Thus, the analysis of case study method were rated more highly, in terms of their overall quality than those that relied on only single sources of information (Yin, 2009).

In addition, validity and reliability process of case study has proven when the researcher adopt rigour and thoroughness in the research design. They were four (4) strategy/test that has been used in the study; (1) construct validity, (2) internal validity), (3) external validity, and (4) reliability (Yin, 2009). The techniques were represented as follow;

(1) Construct validity: The researcher identified correct operational measures of the concepts studied i.e., based on (1) preliminary study and (2) the proposed conceptual framework by Husted (2000) and Gandhi et al (2006). This is takes place in data collection and member's checking stage.

(2) Internal validity: the researcher established an association between variables/ determinants. This because this study had mapped the research design with the conceptual framework based on previous works (Husted, 2000; Gandhi et al., 2006). In this sense, triangulation occurred in data analysis stage. The triangulation process begins when the researcher engaged members' checking procedure reviewing the draft of case study report on data analysis.

(3) External validity: the researcher outlines external validity, which refers to the recognition from the policy maker, namely, SIRIM QAS International and the Department of Environment Malaysia. Therefore, triangulation process takes place when the researcher getting third party approval by validating and confirming the findings on ethical environmental protection by Company A with Department of Environmental Malaysia (DOE), therefore certification and recognition was awarded by SIRIM QAS International and DOE Malaysia to company A for approving the lawful conduct towards environmental protection.

(4) Reliability: Demonstrate that the study can be replicated in terms of data collection with the same results obtained. The triangulation process takes place when the researcher adopts a case study protocol from multiple sources of data from interviews, documents and observation. This is proven when researcher develop a case study database (chain of evidence so that the audience understands the flow of events in the case study reporting). This is because, the goal of reliability is to minimize errors and biases in a study.

As a result, by following all procedures on validity, reliability and triangulation process (Yin, 1994; 2009) research findings in the case study at company A was deemed as credible and represents consistency, dependability and accountability. Therefore, the issues of reliability, validity, trustworthiness, quality and rigor are meant differentiating a 'good' from 'bad' research then increasing the reliability, validity, trustworthiness, quality and rigor will be important to the research in qualitative paradigm (Golafshani, 2003).

6. CONCLUSION

From the foregoing discussion, reliability and validity are conceptualized as trustworthiness, rigor and quality in qualitative paradigm. From the qualitative researchers' perspectives, validity and reliability terms are adopted to eliminate bias and increase the researcher's truthfulness about some social phenomenon (Denzin, 1978) and this is employed through triangulation procedure. Therefore, reliability, validity and triangulation, if they are to be relevant research concepts, particularly from a qualitative point of view, have to be embraced particularly in case study protocol, as we have seen before in order to reflect the multiple ways of establishing truth. Overall, the findings indicates similar validity, reliability and triangulation procedures recommended by Yin (1994 & 2009). Nonetheless, there are additional criteria employed that contributes and advance the validity criteria comparable with Yin (1994; where the researcher employed Creswell (2007) prolong engagement and persistent observation in the field rather than applying Yin (1994 & 2009) recommended on longitudinal study of the company.

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