
Chapter 3 - Methodology

3.1 Background

The current chapter reviews the study's research method strategy in terms of research design, data collection methods and approaches used for the manipulation and analysis of obtained data. The chapter sets forth the approach used in the research that will allow derivation of meaningful results.

3.2 Research Strategy

Research strategy is basically an approach of gathering information to accurately answer the research question and meet the research objectives. The qualitative research can be based on fixed design strategy or flexible design strategy. Fixed design can either be experimental or non-experimental type. Unlike experimental research, the non-experimental research strategy, does not try to bring about any change in particular. Other characteristics are almost the same including that the samples for the study are collected from known populations and measurements are based on minimum number of variables while other variables are controlled. Although non-experimental research may or may not include hypothesis testing (Cole, 2015). The current research study does not use or include hypothesis testing.

Flexible design strategy can be of three major types including case study, ethnographic study and ground theory study (Khaliq, 2014). The current research falls in the category of case study based on the development of in-depth analysis of a single case of Tripoli city. The data collection involves more than one methods e.g. interviews, documents, and observations. A set of data collection methods are used to collect the primary data for this research, these instruments include a questionnaire survey and semi structured interviews. That assists in

obtaining a variety of views and opinions in order to provide good findings and results for this study.

3.3 Research Design

Research design refers to the overall design ranging from data collection methods, type of data and analysis techniques used to carry out the research. Data is an important part of the research to do the analysis. Primary and secondary data have both been of equal importance for the study. Primary data is gathered through conducting questionnaires, and interviews.

A vast majority of research uses separately or in combination two known main design approaches which are;

- Quantitative Approach
- Qualitative Approach

From the above two, qualitative type of research is an exploratory research that deals with defining ideas and dealing the underlying opinions. It deals with an unstructured techniques such as group discussions, interviews, and personal observations etc. The sample size is generally kept small because of its objective nature. While the quantitative research is an experimental and structured based research that quantifies the problem through numerical data and solve it through strong statistical methodology. This type of research is helpful in drawing a definite conclusion about a large group of data on the basis of small and reliable sample.

*Content removed...*Therefore, the current study employs the use of mixed-method research for conducting this research in order to provide quality comprehension of the research issue and to provide a better findings and discussion.

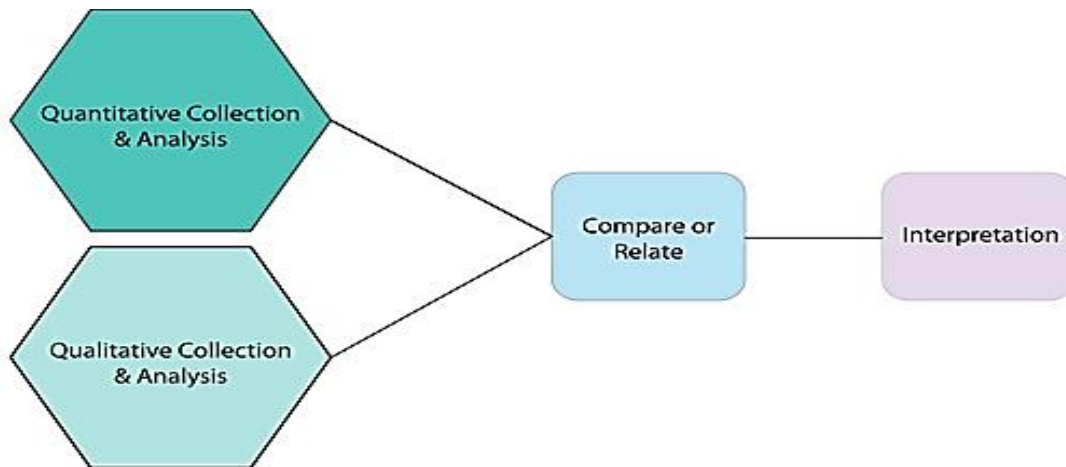


Figure 1- The mixed-method research design (source, Sauro, 2015)

3.4 Data Collection Methods

Data acquisition and analysis is a vital part of the project as the statistics and estimated calculations are derived on the basis of collected data by the people of Tripoli. To acquire qualitative type of primary data, survey questionnaire and semi-structured interview methods are used which are provided in the appendix A and B respectively.

3.4.1 Survey Questionnaire

A questionnaire is defined as a set of written/designed questions, the purpose of the questionnaire is to obtain data and information from a large number of population, as an example of that, to identify points of views of some respondents regarding a phenomenon or a particular issue or interest (Mathers et al., 2007).

As this research is attempting to investigate the application of the anaerobic digestion technology for food waste management and energy generation in Tripoli, in order to establish interpretative frameworks to assessing the potential to adopt such technology, this

questionnaire is to be used as a method to collect information and data from the people in Tripoli.

The proposed survey questionnaire is prepared and kept online for 20 days to gather as much data as possible to make accurate estimations and derive statistics about food waste amount and type of food waste as well as identify views of people regarding AD technology. After the questionnaire is designed and the final version is to be approved. The medium of distribution chosen for the questionnaire was through the internet and targeted through an online survey platform, Survey Monkey. The questionnaire consists of 26 questions and it should an estimate time of 10 minutes or less to complete.

The questionnaires for Tripoli community is intended to investigate the attitudes and role of Tripoli residents (Appendix 2) *Content removed...*

In this research, in order to ensure the reliability and validity of the questionnaire survey, some measures are taken, that includes;

- Taking a great care in designing and writing up the questionnaire to link/connect the questionnaire questions with the objectives of the research.
- Reviewing a draft of the questionnaire with some university students in the University of South Wales (including Libyan students) who are conducting similar researches and see what advices available for improving the question content.
- Carrying out changes and corrections in the questionnaire to improve the questionnaire quality and make the questionnaire more appropriate to conditions of the study.

The online survey link is sent to the two biggest universities in Tripoli city which are the University of Tripoli and the University of Nasser in Tripoli, the online survey link is sent by emails to the

department of Information and Documentation and to the department of Students and Staff Activities in the both universities, then the survey link is distributed among students, staff and lectures (emails are attached in appendix 4). Moreover, as the researcher was graduated from the Higher Centre/College of the Occupational Safety and Health in Tripoli, the online survey link is sent by a Wechat phone message to the general coordinator at the Information Technology Department in this Centre/College in order to distribute the link among staff, students and lecturers to allow them to participate in this survey (the message is attached in appendix 4).

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3.4.2. Semi Structured Interview

A semi structured interview is a uniform qualitative method of inquiry in which the interviewer has a set of pre-determined set of questions along with the opportunity to ask about particular themes and explore responses further. It helps in providing useful information with respect to participant's experiences. The current study uses semi-structured interview, comprising of 7 questions.

In the current study, the interviews are arranged with the General Authority for Environmental Protection employees in Tripoli-Libya. When preparing to conduct the interviews in this research, the researcher considers the following factors;

- Establishing the structure of interviews based on the research questions and objectives.
- Avoiding those questions which may have a dual or multi-concepts. Open questions were specifically drafted so that the participant could elaborate on their opinions
- Identifying the possible number and character of participants from the given population.

- Seeking the permission from those who participate to conduct the interviews.
- Arranging the suitable time for conducting the interviews

When conducting the interviews, adequate preparations are to be made in order to maximise the chances for successful interviews, these include;

- Sending a letter General Authority for Environmental Protection in Tripoli-Libya that explains the overall aim of carrying out this study and to request interviews with them (The letter is attached in Appendix C).
- Selecting a number of 5 participants from the chosen organisation.
- Direct contacts are to be made with the chosen participants to arrange a date and time for conducting the interview, and also to get the participants' full names and contact numbers in order to confirm the proposed appointments.
- Telephone calls are to be made on the day before the appointment day in order to remind the participants of interviews appointment.

A set of seven open questions is employed in the interviews. *Content removed...*

3.4.3. Secondary Sources

Secondary data is defined as information that is collected by individuals or organisation which is not based on their personal first-hand experience in terms of participating in actual event or conditions of research (Daas and Arends, 2012).

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Secondary data obtained for the current study used various sources such as official reports, books, guides, websites, journal articles, and websites. A main source of secondary data for the current study was anaerobic digestion technology efficiency studies that were

extracted from online peer-reviewed journal articles. It was also essential to take into consideration previous research making it necessary to extract data from academic peer-reviewed journals in order to compare and standardise variables of the current study.

3.5 Sampling Strategy

The current study uses two sets of sampling strategies for obtaining data from the questionnaire survey and interview questions. To begin with, the questionnaire survey called for respondents that are homeowners residing and resident of Tripoli. For this reason, a simple random sampling strategy was used to target respondents to complete the questionnaire survey form. According to (Easton and McColl, 1997) simple random sampling is the most basic sampling technique that is used where the research selects a group of subjects for a study from a larger group or population. *Content removed...*

3.6 Data Analysis

The analysis method of the collected data relies on instruments used for the collection of data. However, the analysis of data is a step to output the research results from the raw data collected. The researcher at this stage should be conscious of how to adopt the method of analysis. The raw data gathered prior to this step does not express the full meaning of the respondents. Thence, all collected data, whether it is qualitative or quantitative data have to be analysed in order to provide a full meaning and be useful. In this regard, the nature and the quantity of the gathered data to a certain extent are determining the techniques of analysis to be adopted (Flowerdew, 2005).

3.6.1 Cost Analysis of Data

A detailed financial analysis is a key component of the current study. Essential calculations include cost benefit analysis with respect to power generation capacity of the proposed plant. Internal rate of return (IRR) and Net Present Value (NPV) have been taken as the efficiency parameters for the cost estimation of the plant.

3.6.1.1 Discount Rate Calculation

Internal rate of return (IRR) and Net Present Value (NPV) calculations are the evaluation criteria to evaluate cost benefit analysis. Equation 1 is used to calculate the discount rate of 8per cent based on the assumptions.

$$\text{Discount Rate} = \frac{R_t}{(1 + i)^t}$$

Equation 1 – Discount Rate Calculations

Where;

- R_t is the cash flow.
- i is the Discount rate.
- t is the time of cash flow.

3.6.1.2 Internal Rate of Return (IRR) and Net Present Value (NPV) Calculations

The Internal Rate of Return (IRR) of the proposed project is the discount rate at which the Net Present Value of the project (NPV) is equal to zero, which means discounted costs are equal to discounted benefits. While, IRR is calculated as

$$\text{PV of Future Cash Flows} - \text{Initial Investment} = 0$$

Equation 2- Internal Rate of Return Calculation

Some of the other investment of the plant are

- Planning and license requirements
- Concrete access roads and handling yard
- Investment cost of land and transportation

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Equation 4- Internal Rate of Return Calculation

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Some of the assumptions to carry out further calculations are as follows:

- The plant will operate throughout the year.
- The cost of establishing an AD plant (in the UK) that processes approximately the same (tons) of food wastes generated per year in Tripoli is determined in order to provide the establishment cost of the AD plant in Tripoli.
- 1 British pound is equivalent to 1.79 Libyan Dinar (LYD).
- The estimate rate might be +/- 15%

3.6.2 Quantitative Data Analysis

As discussed earlier, the interviews will be conducted on Skype a video call software that functions through the internet. The interviews have been structured to not last over twenty-six (26) minutes in which participants are asked a series of questions associated to the topic of interest. The initial questions of the interview simply attempt to explore the respondent's job responsibilities within the General Authority for Environmental Protection in Tripoli-Libya.

The semi-structured interview questions used in the current research are found in Appendix B. The remaining seven questions of the interview examine the respondent's opinion on anaerobic digestion plant as a waste management tool and a means for electricity generation. The questions attempt to explore the views of green energy and sustainable initiatives on a government level in order to comprehend the extent in which an AD plan can be implemented in city of Tripoli. The responses obtained from the respondents will be analysed descriptively and then correlated with the data obtained from the questionnaire responses. Responses of the interviewees will be incorporated into the findings by describing the responses in parallel with the quantitative findings.

3.6.3 Ethical Considerations

Bryman and Bell (2007) stated the ethical Considerations are specified as one of the most important parts of any research. The authors argued that the following principles of ethical considerations should be considered:-

- All participants of research should not be undergone to harm in any way.
- Research participant's dignity should be respected as the first priority.
- Full consents from the participants of research should be obtained prior to study
- Ensuring that the privacy of research participants is protected.
- Ensuring adequate confidentiality levels of research data.
- Anonymity of those who are participating in research should be ensured.
- Any deception or exaggeration about the aims and objectives of the research must be avoided.
- Any communication types in relation to research should be implemented with transparency and honesty.

In this research, although data collection involved questionnaire based survey and interviews as well, ethics of the research are always kept first. The primary reason of conducting this research is to satisfy academic goals hence personal data of the population is avoided in the process. The questionnaire does not include any contact information, identity card numbers etc. The research is only done for academic purposes, thus no details of any one from the population is shared with any third party.

The interviews were recorded and then transcribed by the researcher once the interviews are complete. It should be noted that no identifying information were included within the transcription of the interviews. The recordings, transcriptions, and filled questionnaires will be kept in a locked file cabinet and on a password protected computer that is located on the residence of the researcher. All data; transcriptions, audio-recordings, and questionnaire forms, will be destroyed upon completion of the project.

3.7 Limitations and Difficulties

This section describes the limitations and difficulties in regards to the characteristics of the current study's methodology which may impact the interpretation of the results. One of the major research limitations found in the methodology is the use of the English as a primary mode of communication on the questionnaire form. This inevitably creates a bias in the random selection of participants because Libya is primarily an Arabic speaking country. Developing the questionnaire in English automatically withholds a population of Libyans from responding to the questionnaire which as a result withholds opinions from a vast majority of the population about food waste management and anaerobic digestion technology for waste. Furthermore, in regards to the data collection process, it was difficult to carry out a questionnaire survey, the main reason being a majority of people do not have any prior

knowledge regarding AD technology. This may result in lack of participation of some people in Tripoli to fill in the questionnaire survey

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3.8 Summary of the Methodology:

This research adopts both qualitative and quantitative analysis methods. All the data and information are to be reviewed, coded and processed by techniques of qualitative and quantitative analysis. The quantitative data collected from the questionnaire survey is analysed and then the results of the data gathered is represented by a set of techniques such as quotations, citation, diagrams, tables and charts accordingly as to provide more understanding, this is done by using SPSS computer software. The reason for the choice of using this method of analysis is that this method is preferred rather than other methods because it allows greater interactions as well as for better understanding of the collected data and context (Flowerdew, 2005).

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