CHAPTER 3

RESEARCH METHODOLOGY

This study tries to explore the relationship between an environmental policy and the firms engaged in solid waste management (SWM) to the extent that the policy benefits the environment as a whole, and in the process also encourages such firms. There are no standard rules for a good environmental policy and the comparisons are typically between the existing policies in India vis-à-vis policies in certain economies such as Sweden, Denmark and Canada, which are known for environmental development. This study begins by trying to understand the policy environment, the experiences of firms in SWM and how this policy can be affected by making changes in its provisions to help SWM firms improve their performance. This improved performance would in turn help to improve the environment.

A research normally starts with a set of assumptions regarding what would be learnt and how would it be learnt during the research (Creswell, 2007). These are research paradigms and they have been alternatively called/classified in different ways. Crotty (1998) called them philosophical assumptions, epistemologies and ontologies. Denzin and Lincoln (1998) explained a paradigm as a basic belief system or world view that helps the researcher in terms of approaching or dealing with research, starting from ontologically and epistemologically fundamental ways to choosing the methods of inquiry. They identified three elements in a paradigm: epistemology\textsuperscript{15}, ontology\textsuperscript{16}, and methodology.

\textsuperscript{15}Epistemology deals with how we know the world and what is the relationship between the researcher and the known. It is the study of the process of knowing or “how we know what we know” (Guba & Lincoln, 2008). It is concerned with how we gain knowledge of what exists and the relationship between the knower and the world or what would be known.
On a similar note, Crotty (1998) laid out two basic questions to be answered while developing a research proposal: what are the methodologies that need to be employed and how are those methodologies justified?

In this study, an attempt has been made to explore the SWM industry to understand the creation and modification of policy considering the context of the environment and firms operating in the area of SWM. The ontological position of this study suggested to adopt Constructivism\textsuperscript{17} as an epistemological approach since there is no standard or perfect environmental policy in mind.

This study also gathers information by recording information available with the key respondents in SWM firms that are being studied. It tries to understand the situation from their perspective and takes suggestions on how their working can be improved to help improve the environment as well. The constructivist process is largely inductive and the meaning is generated from the data collected from the field (Creswell, 2007; Crotty, 1998). The answer to the questions in this study will be constructed from the views given by the participants from their own unique contexts. Meanings have been derived from the views of the participants, who are encouraged to express themselves in response to broad and open-ended questions. The context is business of firms in the SWM industry and the role that environment policy plays to improve the sustainability.

\textsuperscript{16} Ontology tries to understand 'what is', the form or nature of existence or the structure of reality and what can be known about it. In the backdrop of qualitative research, ontology is discussed in terms of beliefs about the existence of some "universal truth" and about objectivity (Hays & Singh, 2012).

\textsuperscript{17} The four alternative knowledge claims generalized by Guba and Lincoln (1994) are: Positivism, Post-positivism, Critical theory and Constructivism. Creswell (2003) identified the schools of thought as Post-positivism, Constructivism, Advocacy/Participatory and Pragmatism. These knowledge claims combine the ontology as well as epistemology.
RESEARCH DESIGN

There is little research done in this area in the specific context of SWM firms and linkages with the existing environmental policy. This study tries to explore the two aspects and also attempts to draw meaning from the available data in the form of policies and also from the views given by the participants, who are key resource persons in firms engaged in SWM. As this is a constructivist approach, it is easily amenable to qualitative research approach\(^\text{18}\) to conduct this study (Creswell, 2007).

This study uses the case study method to understand the situation and help create meaning from the context. A case study, as defined by Yin (1994), is an empirical enquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between the phenomenon and the context are not clearly evident. It presupposes multiple sources of information. This study also straddles different scenarios such as public administration, policy development, management studies and urban and rural planning. These are also areas where the case study method can be used as a research strategy as mentioned by Yin (1994). The case study can be used as a research strategy in situations including policy, political science and public administration research, organizational and management studies, and city and regional planning research.

This study presupposes no right or wrong situations. The solutions as suggested by the participants are accepted without judgment and tried to be juxtaposed with the opinions of other

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\(^\text{18}\) Creswell (2007) has suggested five major approaches to qualitative research - ethnographies, grounded theory, case studies, phenomenological studies and narrative research. In Ethnographies, an intact cultural group is studied in a natural setting over a period of time through observation. In Grounded theory - meaning or an abstract, general theory is tried to be derived from a process or action from the participants’ views. Case studies are used to explore an event, programme, person, activity or process in depth. Phenomenological studies are used to capture the essence of experiences of people in connection with a phenomenon. In narrative research, individuals provide stories about their lives which is re-chronicled into a narrative by the researcher.
participants and also in the larger context of environmental development and protection. Case study research is capable of being used within both the positivist and the interpretivist/constructivist philosophical frameworks (Cavaye, 1996). Case study inquiry is also assumed to be value free, which allows for objective, detached and neutral analysis. This study broadly falls in the area of public policy and is exploratory in nature. There has been very little research in the area of environment policy and the operations of firms in the EGS sector in India. This is why the constructivist approach is highly preferable and the case study method of research can be invaluable to uncover insights and views to help shape future research in this area. While the firms in the area of SWM are relatively few and scattered, they are still adequate in order to obtain literal and theoretical samplings. The unique feature of the SWM industry is that it is yet to be classified as such in major industry listings. Such a classification can help in studying and analyzing it further. The questions to be answered through this research are mainly ‘how’ in nature and this needs an examination of data at the micro level. There is less a priori knowledge of concepts and variables and things become clearer as the data collection progresses. There is a lot of scope to make this study richer by examining different angles of the cases from which data can be collected and used for triangulation.

Due to the lack of pre-existing information and cases in this area, this study can be classified as an exploratory study. A particular problem - the link between environment policy and SWM firms in the context of improving the environment is tried to be studied in detail and to establish a base for future research questions. Yin (1994) classifies case studies in research as descriptive, exploratory and explanatory19.

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19Exploratory case designs help to design feasibility of research procedures and to establish questions of future research (Hancock and Algozzine, 2006). These types of cases try to explore a particular phenomenon or phenomena in the data, which is of particular interest to the researcher. The questions asked are general in nature.
This study also had the choice of studying one case in absolute detail and studying multiple cases to a lesser detail but to an adequate extent so as to derive meaning from the whole exercise. The multiple case study approach helps understand the same problem from the different perspectives of the unrelated SWM firms. These firms are spread across different cities in the Western and Southern India, providing adequate heterogeneity within the same subset of industry segment. Multiple case studies or collective case studies also involve a single issue selected for study but here, multiple cases are used to highlight the point of reference and understanding. The multiple cases are used to show the different perspectives of the issue being discussed (Yin, 1994).

Case study research focuses on understanding the dynamics present in single settings and in some cases, tries to explore existing and predefined phenomena. It enables examination of data at the micro level (Zaidah and Zainal, 2007; Hancock and Algozzine, 2006; Yin, 1994; Eisenhardt, 1989). Multiple research goals can be accomplished through a case study research, including providing descriptions of phenomena, developing theory and testing theory. In case of exploration of areas where pre-existing knowledge or research is limited, or even for hypothesis generation, case study research can help with description and with theory development to provide evidence for such cases (Cavaye, 1996).

and the study of which may lead to further and more detailed examination of the phenomenon being studied (Zaidah and Zainal, 2007). Descriptive case studies try to describe the natural phenomena which exist in the given set of data. Here, the researcher tries to describe the data as they occur and can be in the narrative form. It should begin with a descriptive theory that helps in the description of the events in the research (Zaidah and Zainal 2007; Tellis, 1997). Explanatory case studies are causal studies that aim to provide different sets of explanations for the same set of events and may lead to the selection of the best possible option (Yin, 1994). They seek to understand cause-and-effect relationships or the relationship between the occurrence of events and the impact on the outcomes (Hancock and Algozzine, 2006).

In the single or instrumental case study the researcher identifies one particular issue of focus and then illustrates that point with a single case study. The attempt is to obtain in-depth understanding of a theoretical question or problem using a single case (Creswell, 2007; Hancock and Algozzine, 2006).
**Research Approach**

The two dominant methods of reasoning are deductive and inductive reasoning. In this study, I try to understand the situation at the ground level - the operating issues with the SWM firms and problems faced by them. Thereafter, it draws linkages with the environmental policies and creates a pattern to understand how such policies could be modified to help the SWM firms and also help create positive externalities. While these learnings are compared with the existing theories in Environmental policy studies, I have emphasized on the analysis of data that emerges from the interactions at the ground level of operations. This approach is called the inductive method (also known as the ‘bottom-up’ approach), where the phenomenon is observed, a pattern is looked for, a tentative hypothesis is created based on the observed patterns and then there is addition to the existing theory. The deductive method is also called the ‘top-down’ approach and it moves from the general to the specific. The difference between the two methods is whether the theory is the starting point of the research (deductive) or the ending point (inductive).

For this study, the case study method for exploratory studies is quite amenable to the inductive method of reasoning and hence, the analysis of data\(^2^1\) follows the same path.

**METHODOLOGY**

**Case Selection**

*Unit of Analysis:*

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\(^{21}\) It is possible that both the methods of reasoning could be used; e.g.: the data is drawn from observation and used to create tentative hypothesis (inductive), but the analysis or some of the codes could be drawn from the existing theories and literature on environmental regulation (Baxter and Jack, 2008).
This explains what the ‘case’ is. It could be an individual, decisions, programmes or any such less clear entities (as compared to individuals). In this study, based on the research questions the primary or sampling units of analysis are public and private limited companies (hereafter called ‘firms’) engaged in the management of solid waste in India. The activity of management of solid waste encompasses recycling, composting, converting into fuel and so on.

It is necessary to define this at the start of the research since it also guides the collection of data and also helps to establish the context. Identifying the people who fall outside the group helps to establish the context. To a great extent, the framing of the research questions helps in identifying the ‘case’ or unit of analysis (Yin, 1994).

**Type of Case Study:**

For this study, I have chosen multiple case design, where ten cases across different cities in India have been selected for in-depth study. This has been done primarily to study the same phenomenon across different firms in different conditions. While the commonality is the SWM industry, the heterogeneity is in the sub-categories of SWM, the geographical regions the firms operate in and also the population they cater to.

Single case studies are preferred when the case is representative of a test to an existing theory, where the case itself is a rare and unique event or where it is revelatory. In the absence of these three main criteria, multiple case studies are preferred. Yin (1994) has described four types of case studies by using on a 2x2 matrix. He first talks about single case studies and multiple case studies. Within these, there could be single (holistic) or multiple (embedded) units of analysis. Hence the four types are classified as (i) single case with single unit of analysis, (ii) single case with multiple units of analysis, (iii) multiple cases with single unit of analysis, (iv) multiple cases with multiple units of analysis.

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22Yin (1994) has described four types of case studies by using on a 2x2 matrix. He first talks about single case studies and multiple case studies. Within these, there could be single (holistic) or multiple (embedded) units of analysis. Hence the four types are classified as (i) single case with single unit of analysis, (ii) single case with multiple units of analysis, (iii) multiple cases with single unit of analysis, (iv) multiple cases with multiple units of analysis.
study designs have the capability of providing evidence, which is more compelling, difficult to ignore and more robust. While this method requires extensive time and resources, it helps create the replication logic (similar to conducting multiple experiments), as opposed to sampling logic (surveys or multiple subjects within and experiment). This replication logic or the replication of findings across cases, which is being aimed at in this study is at the core of the case study design (Yin, 1994).

**Sampling**

In this study I have made an attempt to understand the SWM industry and policy issues. Purposively, SWM firms were approached for data collection. Thus, I have adopted the purposive sampling method for the study. The intention of sampling and selecting cases for the multiple case study design is to achieve replication logic instead of sampling logic. The process of identifying SWM firms for participation in this research consisted of gathering information from multiple sources such as websites, newspaper clippings and articles, blogs and lists from professional bodies. From this small pool of information, some cases have been identified which are in the area of SWM. At first, the three major cases, being large players in the area of SWM in India were identified. After that, other firms in this area were identified and tapped.

The methodology involves ‘cross experiment’ analysis instead of ‘within experiment’ analysis. The cross experiment approach should lead to (a) similar results across the selected cases, also called a literal replication, or, (b) contrasting results but for predictable reasons (theoretical replication). For the efficient functioning of the replication logic, a rich theoretical framework needs to be in place, which would state under which conditions a particular phenomenon would be found (literal replication) and
under which conditions would the phenomenon not be found (theoretical replication). Theoretical sampling involves choosing cases, which are likely to replicate or extend the theory being discussed or fill theoretical subspaces and provide examples of extreme arguments (Eisenhardt, 1989). The findings of the case studies are generalizable to the theoretical propositions, not populations or universes. Therefore, the case study enables expansion and generalization of theories (analytical generalization) and does not look to enumerate frequencies (statistical generalization) (Yin, 1994).

**Sample Size**

The boundaries for case selection included conversion of biodegradable waste into biogas, conversion of non-biodegradable waste into fuel, bio-medical hazardous waste management, manufacturing of organic waste converters and recycling of the solid waste. These boundaries were set based upon the findings from the review of literature. It is estimated that two-three cases from each sub-area would suffice to derive the required saturation. A number of firms in these six sub-areas, including two of the biggest in India, were initially shortlisted for the study. E-mails were sent to them introducing myself, the Institute and the topic of research, in addition to outlining the requirements from the firms for this study. These emails were followed up with telephone calls to either the project in-charge wherever available, or to the company board line with a request to connect to the concerned person. Some of these firms did not respond to the emails (the initial and their subsequent follow-up emails) nor, to the phone call attempts. A few of them responded to the emails or phone calls but declined to participate in the study citing a variety of reasons, including not being able to share financial information, which they deemed sensitive to their operations. The remaining firms responded positively but two
of these did not turn out to be in the specific area this research was looking at. This information was not available from their websites as the same had not been updated and clarified. The remaining firms, ten in number, were considered as participants in the study. These ten firms are divided into the sub categories as follows: two firms are engaged in recycling of waste, i.e. collecting waste from households and commercial establishments and selling them to recyclers or recycling it themselves, one firm converts plastic waste to fuel, one firm is handling bio-medical hazardous waste and incinerating the same, three firms are engaged in converting biodegradable waste into either bio fertilizers or refuse derived fuel (RDF) and three firms are producing organic waste converters. This mix of activities is thought to be sufficient enough to derive data that can achieve the theoretical sampling logic and also provide replication of findings. These firms were situated in different geographical locations such as Chennai, Bangalore, Karkala, Mumbai, Surat, Pune and Ahmedabad. The respondents were either Managing Directors (MDs) or CEOs of the firms and a total of 14 interviews were conducted for the ten cases.

The list of firms selected and the sub grouping they fall under are given in Table 2:

**Table 2**

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Name of Firm (masked)</th>
<th>Place</th>
<th>Sub-category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Firm A</td>
<td>Bangalore (Karnataka)</td>
<td>Organic Waste Converter machines</td>
</tr>
<tr>
<td>2</td>
<td>Firm B</td>
<td>Mumbai (Maharashtra)</td>
<td>Organic Waste Converter machines</td>
</tr>
<tr>
<td>3</td>
<td>Firm C</td>
<td>Karkala (Karnataka)</td>
<td>Bio-medical waste management</td>
</tr>
<tr>
<td></td>
<td>Firm</td>
<td>City</td>
<td>Service Provided</td>
</tr>
<tr>
<td>---</td>
<td>--------</td>
<td>---------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>Firm D</td>
<td>Mumbai (Maharashtra)</td>
<td>Conversion of organic waste to fuel</td>
</tr>
<tr>
<td>5</td>
<td>Firm E</td>
<td>Ahmedabad (Gujarat)</td>
<td>Recycling of solid waste</td>
</tr>
<tr>
<td>6</td>
<td>Firm F</td>
<td>Pune (Maharashtra)</td>
<td>Conversion of organic waste to fuel</td>
</tr>
<tr>
<td>7</td>
<td>Firm G</td>
<td>Chennai (Tamil Nadu)</td>
<td>Conversion of plastic waste to fuel</td>
</tr>
<tr>
<td>8</td>
<td>Firm H</td>
<td>Bangalore (Karnataka)</td>
<td>Organic waste converter machines</td>
</tr>
<tr>
<td>9</td>
<td>Firm I</td>
<td>Bangalore (Karnataka)</td>
<td>Conversion of organic waste to fuel</td>
</tr>
<tr>
<td>10</td>
<td>Firm J</td>
<td>Ahmedabad and Surat (Gujarat)</td>
<td>Recycling of solid waste</td>
</tr>
</tbody>
</table>

The limitation of the sample was that more than one firm in the sub-categories of inorganic waste-to-fuel and bio-medical waste management could not be obtained. The remaining two sub-categories had two to three samples, which was as planned. However, the findings did provide adequate information for processing.

After ten cases, I felt that there was replication of findings and I was getting little new information. Qualitative studies use smaller sample sizes than quantitative studies\(^{23}\). Phenomena need to appear only once on an analytical map in qualitative research. Hence, after proper analysis, it is possible that additional units of analysis may provide recurring patterns and replication of findings. There could be a situation of diminishing returns.

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\(^{23}\)Qualitative research concerns itself with uncovering meaning rather than making generalized hypotheses. Secondly, enumeration of frequency of phenomena is rarely of concern in qualitative research. It is the occurrence of the phenomena which is studied, rather than the number of times they present themselves. Lastly, the analyses of data in qualitative studies leads to rich and varied information. A larger sample size might actually hamper the appropriate analysis of the information in detail and it may not be possible to do justice to the information (Ritchie, Lewis and Elam, 2003)
where the additional units may not provide additional findings, which leads to ‘saturation’.

Yin (1994) suggested a sample of six to ten cases\(^{24}\) where two or three cases could be literal replications, another four to six could follow at least two different patterns of theoretical replication, thus providing rich and compelling data to support the propositions. The selection of number of replications depends on the certainty required for the case results. For example, when there are clear rival theories and the issue does not require a great amount of certainty in results, two or three replications would suffice. However, when the theoretical differences are more subtle or a higher amount of certainty in results is desired, five, six or more replications would be necessary (Yin, 1994). Eisenhardt (1989) suggested the use of four to ten cases as desirable for theory building.

**DATA COLLECTION**

**Tools of Data Collection**

Having established the ontological and epistemological base for this research, the case study method has been identified as the most appropriate methodology to look for information and collect data. Yin has highlighted six main sources of evidence for the case study method: documentation, archival records, interviews, direct observation, participant observation and

\(^{24}\)The case study methodology is often critiqued on the fact that its dependence on a single case, or a microscopic study, may not help in arriving at a generalizing conclusion. However, Hamel et al. (1993) aver that the relative size of the sample whether 2, 10, or 100 cases are used, also cannot transform a multiple case into a macroscopic study. Getting into the argument of numbers here is contrary to the very principle of case study methodology. The goal of the study should establish the parameters, and then should be applied to all research. From this perspective, even a single case meeting the established objective could be considered acceptable (Tellis, 1997; Hamel et al., 1993).
physical artefacts. In addition, he has cited Marshall and Rossman (1989) for other sources such as films, photographs, videotapes, street ethnographies and life histories. From this list of possible sources, the following have been used for this research:

1. **Interviews**: I chose in-depth interviews as a data collection tool mainly due to the exploratory nature of the study. As the topic of the research study indicated that the perception of the SWM firms need to be explored, I felt to adopt in-depth interview method by using guided check list for the data collection. These interviews were sought of the main individuals or key informants who could provide exhaustive and reliable information about the working, operations, finance and strategies of the firms and the environment in which they worked. Since most of these firms were not very large ones, the individuals providing this information were either the MDs, Directors or CEOs. In some cases, the interviews of Finance heads were also taken. A total of 14 in depth interviews were conducted. Since the constructivist philosophy of research was guiding this study, more open-ended questions were asked and questions were formulated based on the responses provided. The main line of questioning involved the following guided checklist:

   i. The reason and vision for starting the business and entering this domain;

   ii. The environment in terms of competitors and supply chain;

   iii. Description of operations;

   iv. Markets for the end products;

   v. Issues or roadblocks faced in these operations and in achieving the desired goals;

   vi. The financial outlook and views on sustainability;
vii. Features in the current environmental policy that were aiding their operations and vision; and

viii. Features that could be incorporated (suggestions) to improve the current environmental policy and aid them further.

Most of the respondents found this line of questioning comfortable and responded well with a host of information about their area of operations and the current environment policy.

2. *Direct Observation*: Wherever possible, I visited the field\(^{25}\) in order to get a first-hand idea of the firms business and the issues encountered by them. This was necessary to have a better understanding of the context of the firm and its processes, and also help triangulate certain information given during interviews. In three cases, it was not possible to do so since the operations were at a distance from the offices and the key informants were not available at a later date to help in the visit. In cases, where direct observation was possible, in addition to viewing the SWM operations and the conditions it operated in, there were chances of speaking to the operations in-charge of the plants and also key supervisors and other employees. While the focus was not mainly on the day-to-day operations, it provided an insight into some possible policy measures that could be thought upon relating to HR issues. This insight was translated into questions in some cases, which elicited appropriate responses from the key informants.

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\(^{25}\)A field visit to the case study site creates more opportunities for directly observing activities and problems and also helps get a better understanding of the context the firms work in. Since the phenomena of interest is not historical and is quite current, this method is appropriate to add value to the other techniques used in this case study (Hancock and Algozzine, 2006; Tellis, 1997; Yin 1994).
3. *Documentation and Archival records*: Documents play a vital role in data collection in the case study method because of their high value as recorded information. In all cases, documents were sought for and I collected regarding the operations, the overall vision and mission of the firm and other related information. In most cases, the key informants were forthcoming with leaflets, brochures, reports, press information, etc. of their own accord. They appeared to be keen to provide background and contextual information about the firm so that their point of view was not missed out. The information from documents and other such sources helped in the triangulation of information gathered from primary sources.

4. *Others*: I also obtained the data from the websites of the firms participating in this study. This data was quite general in nature but provided a base for filtering the queries during the actual interviews. A part of the data also came from news articles and press clippings about the firms or the industry they were associated with. There were two articles that provided information on the startups in the area of SWM in India. These lists also ended up providing the names of firms, which could be possibly tapped for the study. Some firms provided videos of their business operation and one could provide a link to a video uploaded on social media such as YouTube that provided information about the activities they were involved in. Websites such as National Solid Waste Management Association of India (NSWAI) and social media such as Facebook groups in this area also provided data for this study.
Collection of data

Having identified the suitable samples and after getting their approval for the interviews, the next step was to collect specific background information about the firm in question (Darke et al., 1998), mainly from the website of that firm. This gave a lot of insights about the products, operations, location and scope of the case. For example, some cases dealt only with non-biodegradable waste, whereas others managed biodegradable waste exclusively. A few firms managed composite waste including biodegradable and non-biodegradable waste. Also, information about the end product of these firms helped me to frame appropriate questions on the financial sustainability of the firm and future scope. Further, the interviews happened at different places and at different time frames. All the interviews were conducted mostly in English language. In a few cases, where the respondents used certain phrases in Hindi, I have translated them into English. While the data collection started in 2012 with a pilot study and concluded in March 2016, there were quite a few appointments, cancellation of appointments and re-appointments in between. Travelling was also an issue since the field visits were in diverse places such as Mumbai, Pune, Chennai, Ahmedabad, Bangalore, Mangalore and Karkala. The interviews, all with prior permission, also took place in different locations. While most interviews happened at the given places and offices, not all of them could be backed up by field visits to the operational plants due to distance or time issues. The interviews lasted from 25 minutes to 90 minutes, with some having been taken in two parts due to paucity of time in the first meeting. Documents, brochures and video CDs were collected from the offices of the firms and in some cases, collected on the second visit. Links to online videos were also taken at that time. Financial statements were not available in all the cases.
All the interviews of the key respondents of the cases were recorded using a digital voice recorder so as to enable concentration on the responses and gain adequate time to focus on the next question, since the questioning method was open-ended and most of them were emerged during the interviews. During field visits, important points relating to the case were jotted down and kept ready for future data analysis.

**PILOT STUDY**

A pilot study, to test the chosen methodology was conducted during the initial part of the study by collecting data on a company engaged in plastic waste to fuel conversion. This company is engaged in receiving plastic waste from various sources in Chennai, including from the Municipal Corporation, and converting it into fuel which has multiple uses. The CEO was asked about the background of the organization, the problems the organization faced and the possible solutions.

The analysis of the data has been done by classifying the information at different stages into key areas of importance. Further, data has also been collected through secondary sources such as newspapers, magazine articles and websites, including that of this company.

The data was analyzed and the problems faced by the firm vis-à-vis the working environment and the environmental policy were drawn out and highlighted. This led to a better understanding of the situation such firms work in and also about the policy instruments that are applicable to them. Some lines of questioning were found to be quite productive and were used in subsequent cases in the regular data collection phase. The following broad guideline for interviews emerged from the pilot study related activity:

- Introduction to business and motivation for starting this line;
• Operational issues of the business;
• Financial performance;
• Environment policy features contributing to the current operations;
• Bottlenecks and problems faced during the operations;
• Scaling plans and envisaged issues; and
• Suggestions for improving the current environment policy in relation to business operations.

DATA ANALYSIS

The data from ten different cases has been analyzed using pattern matching\textsuperscript{26} and also matching the findings with the existing policies. The policies and data from other sources have been used for triangulation as well, since the validity and robustness of the study depends to a great extent on the same.

In pattern matching, an observed pattern is compared with a predicted set. If these patterns coincide, the results could strengthen the internal validity of the case study through literal replication. If the predicted patterns are rival in nature, it could either lead to literal or theoretical replication or both (Campbell, 1975). This method has been found most suitable for this particular research.

\textsuperscript{26}Yin (1994) had suggested four main modes of analysis in case studies - pattern matching, explanation building, time series analysis and program logic models. Explanation building is complex form of pattern matching where an initial theoretical statement is made and compared with the findings of an initial case. Time series analysis and program logic models try to compare the behavior of variables over different time periods and data points.
Denzin (1984) identified four types of triangulation: Data source triangulation, Investigator triangulation, Theory triangulation and Methodological triangulation. This study uses data source triangulation, where different sources of data from different contexts are used to confirm the results.

**Transcribing and Coding**

The data collected through interviews was recorded and thereafter transcribed, thereby leading to more familiarity with the cases and also more insights, as one kept hearing and reading the same interview at different points in time. All the interviews were in English. Some respondents used a few phrases in Hindi, which were duly translated. The transcribed data was collected and kept in a database sorted by the case name and date of recording. In ‘within case’ analysis, the data was first coded using open codes. While some of the codes came from existing literature as mentioned earlier, most of the coding came from the collected data. For example, ‘problems with municipal corporations’ came from the transcribed data and became a code by itself. The codes that were interrelated or corresponding to a common theme were grouped under sub-themes. The sub-themes with commonalities were then brought under the common themes, which came after the review and the examination of the sub-themes. The above example of problems with municipal corporations could be bunched with other related problems under the common heading ‘regulatory issues’. Finally, all such themes were clubbed under concepts that are related to existing theoretical propositions. Patterns were continuously sought to be observed among all the themes, sub themes, concepts, etc.

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27Investigator triangulation, where the same phenomenon is investigated by different investigators; Theory triangulation, which is slightly different from the preceding type, when investigators with differing viewpoints or from varied schools of thought, interpret the same results; and Methodological triangulation, when different analytical approaches are used in the same case to increase the validity of the interpretation (Denzin, 1984).
**Within-case and Cross-case analyses**

For this study, each case was written about in detail using the data gathered from interviews, brochures, other documents and observations. Patterns were identified within each case and issues, sub-themes, themes and concepts were matched and extracted from the case. Following this, a cross case analysis was done after the analysis was completed for all the ten cases individually. The emergent themes and concepts across the cases were compared and mapped for patterns. As the comparisons went on, deductive reasoning was used more often and the emerging sub-themes were looked at from the view point of the existing theory and literature. The themes were grouped under concepts such as green taxes and subsidies, which are components of environmental regulation.

**Comparison of findings with existing theories**

I compared the findings of the case studies with existing theories in literature related to environmental policy. These concepts were sought to be linked to existing concepts in this area. A few of the codes were created keeping in mind the five basic concepts of environmental policy, i.e. regulation and standards, subsidies, green taxes, pollution permits and negotiations. For example, some of the data started as problems faced with the municipal corporations but ended up under the established concept of ‘regulations and standards’. Thus, there was an element of deductive reasoning also used in the data analysis. The purpose of case study was also achieved to a great extent when there was literal as well as theoretical replication. When the types of problems faced in some cases were replicated across cases, there was literal replication. However, some firms gave contrasting solutions to the problems faced by them, leading to theoretical replication. This typical feature of the case study

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28Within case analysis involves a detailed description of each case or site which is pivotal in generating insights. In the initial stages of research, it helps in dealing with the enormous volumes of data (Eisenhardt, 1989).
method is expected to lend credibility to the research and make the findings more compelling.

**Validity and Reliability**

The data collected from interviews has also been compared with data from websites, newspaper and blog extracts, and other sources to ensure reliability and minimization of errors. The detailed information collected about the firms in question and the processes used by them have helped understand the conditions under which the instances could occur and re-occur and the information of one firm has refined the information gathering of subsequent firms, thus reducing the scope of errors.

Validity refers to the correctness of the concepts and findings and reliability concerns the degree of consistency of assigning instances on different occasions. Both of these concepts are crucial to the acceptability of the research and its findings. In this research, while there have been instances of the existing theoretical constructs finding their way into data collection at initial levels, conscience effort has been made to keep the originality of the communications by the informants intact. At times, the direct narrations of the informants have also been used. The internal validity of the research is further strengthened by the use of multiple sources of data since these sources have helped triangulate the findings (Yin, 1994). Development of the case study protocol has been considered one of the major methods to achieve reliability (Tellis, 1997). Each step of the case study such as case selection procedure, data collection, analysis, arriving at theoretical frameworks, etc. has been documented.
ETHICAL CONSIDERATIONS

Every effort has been made in this study to follow the ethics of the research process and also uphold the name and reputation of the Institute. Interviews have been conducted after taking proper approval of the informants and also informing them of the purpose and aim of the process. The informants have been informed that this was not a magazine/newspaper interview and the outcome of the process would be used in the thesis. This information has been conveyed by email as well as over telephone. Full information has been given about the nature of the study, the place where the PhD is being pursued, details of the guide and about the nature of activity of the researcher. During the interviews, the informants were asked if they were agreeable to the interview being recorded and the recordings have been made only after their consent. The participants were also informed that they could stop the interview at any time. The data regarding the firms and products have been masked in the study to maintain the confidentiality. The respective recordings have also been mailed to each interviewee.