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thesis entitled

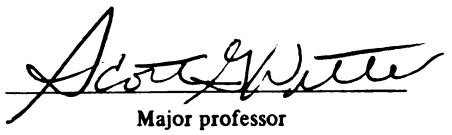
The Implementation Process of a Demonstration: A Case Study of a Wastewater Reclamation and Reuse Project on the U.S./Mexico Border

presented by

James Rankine Harding

has been accepted towards fulfillment of the requirements for

Masters degree in Resource Development



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THE IMPLEMENTATION PROCESS OF A DEMONSTRATION: A CASE STUDY OF A WASTEWATER REUSE AND RECLAMATION PROJECT ON THE U.S./MEXICO BORDER

By

James Harding

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Resource Development

2000

ABSTRACT

THE IMPLEMENTATION PROCESS OF A DEMONSTRATION: A CASE STUDY OF A WASTEWATER REUSE AND RECLAMATION PROJECT ON THE U.S./MEXICO BORDER

By

James Harding

Within the study of diffusion of innovations, the demonstration is considered an important means of speeding the rate of diffusion. However, the details of the demonstration, specifically the process of implementing a demonstration, has not been studied in great detail. Therefore this study takes the case of Ecoparque, a wastewater reclamation and reuse project in Tijuana, Mexico, to examine the process of implementation of an innovative technology in a demonstration project.

Using a qualitative analysis of open-ended, semi-structured interviews and written documents, this study documented the implementation history and examined the barriers and facilitative factors that affected the implementation of Ecoparque. The barriers included political and financial issues as well as an overall resistance to change. The facilitative factors included political connections, individual motivation, and the flexibility to change throughout the entire process. Overall, the process of implementing Ecoparque followed a model of adaptation between the innovation and innovation environment which appeared to facilitate its success despite numerous barriers and setbacks.

ACKNOWLEDGEMENTS

When I began thinking about different thesis topics after entering a master's program in the department of Resource Development, I never would have guessed I would be writing about the process of implementation of a demonstration project in Tijuana, Mexico. Nor did I ever expect I would conduct a case study based on qualitative research. All the pieces to the puzzle, however, slowly came together. This section of my thesis is devoted to recognizing those people who helped me along the way.

A number of people at Michigan State University provided invaluable help with the research and writing of this thesis. My advisor, Scott Witter, has supported me through my studies and devoted a significant amount of time to the development of this thesis. My other committee members, Frank Fear and Jim Dearing, perhaps two of the busiest people on campus, made themselves available time and again for advice and direction. Another professor, Scott Whiteford, showed interest in my research plans and went out of his way to find a way to send me down to Baja California. His colleagues in Mexicali introduced me to border water issues and ultimately lead me to Ecoparque. Drs. Witter and Fear also contributed funding for this research, as did the Department of Resource Development, the Center for Latin American and Caribbean Studies, and the Graduate School. I could not have completed my research without all these forms of support.

A number of people also helped me while I was conducting my research away from Michigan State. In particular, I would like to thank my friends Icela Lopez and Arturo Mejia, whom I met in Mexicali while looking for a research topic. I am indebted to them for taking so much time out of their lives to help me with my research and to

make me feel so welcome. I am indebted also to Mike and Patricia McCoy, who opened their doors to me and gave me a place to stay while I collected data for this study. They were a researcher's dream come true. I also appreciate the kindness David Campbell and his family showed me while I was in California conducting my research. They generously invited me to stay with them each weekend, giving me a comfortable atmosphere in which to process the data I collected during the week. Lastly, I would like to thank Carlos de la Parra. I credit our very first conversation as being the spark for most of what plays out in the pages that follow.

I would also like to thank my classmates in the Department of Resource Development. They helped pull me through some difficult material and months of cold weather and cloudy skies. Loretta Ishida deserves a special note of gratitude. She, more than anybody, has helped me make it through graduate school.

Most of all, I would like to thank my parents, the two most wonderful people in the world. Thank you Mom and Dad for continually encouraging me to broaden my horizons.

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LIST OF ABBREVIATIONS

Coastal Conservancy	California State Coastal Conservancy
CESPT	*Comisión Estatal de Servicios Públicos de Tijuana*
CILA	*Comisión Internacional de Limites y Aguas*
CNA	*Comisión Nacional de Aguas*
COLEF	*Colegio de la Frontera Norte*
COSAE	*Comisión de Servicios de Agua del Estado*
EDF	Environmental Defense Fund
IBWC	International Boundary and Water Commission
PRODUTSA	*La Promotora de Desarollo Urbano de Tijuana, S.A.*
SAHOPE	*Secretaría de Asentamientos Humanos y Públicas*
SEDUE	*Secretaría de Desarollo Urbano y Ecología*
SDSU	San Diego State University
SWIA	Southwest Wetlands Interpretive Association
UCSD	University of California San Diego

Chapter 1

Introduction

Problem Analysis

During periods of rapid population and economic growth, urban areas around the world have traditionally sought to meet increased water demands by augmenting their existing supply with new fresh water supplies. This practice, however, is quickly changing. New untapped sources of water are now often located too far away or in too small a supply to warrant the cost of their capture and delivery. People have also realized that they can increase water supplies simply by making better use of the water they already have available. As Sandra Postel (1997: 22) wrote, "Doing more with less is the first and easiest step along the path toward water security".

In an effort to use their water supplies more efficiently, people have begun employing methods such as installing low-flow devices, locating and repairing leaks in distribution systems, installing meters, and developing public education programs (Schilling 1992). Each reduces the total amount of water lost to infiltration, evaporation, runoff, or simple waste.

Water security, however, is not the only water issue these areas are facing. Falkenmark and Lindh (1993: 87) report that, "The problem of wastewater disposal rivals that of water supply in many urban areas". Populations in some urban areas are growing so quickly that local governments are simply unable to continue to provide adequate sewerage and treatment services. For instance, in the early 1990s, the World Health Organization estimated that only 41% of the urban population in Latin America and the

Caribbean had access to sewer systems and that 90% of the wastewater collected was discharged into local waterways without treatment (Nash 1993). As a result, these growing populations are also becoming increasingly exposed to the threat of waterborne diseases.

Many urban areas have typically attempted to solve their wastewater problems by expanding sewer systems and building more waste treatment facilities. This solution, however, has only had limited success. Continued growth makes improvements almost invisible, particularly in developing countries where urban populations are growing the fastest and funding for infrastructure is low (Gleick 1993).

Consequentially, these same areas have begun to explore other means for resolving their wastewater problems. The list of solutions has included using more on-site disposal systems (Kindler 1992), stabilization ponds or lagoons, and constructed wetlands (Moshiri 1993, Hammer 1989). This list also includes wastewater reclamation and reuse (Asano 1998, Asano and Levine 1996, Okun 1991), which addresses both water supply and pollution abatement issues at the same time.

People encounter problems and challenges in all aspects of life, including the water supply and wastewater disposal problems discussed above. To overcome these problems, people seek to find solutions. In other words, people seek positive change in their lives; positive change can be considered "development" in its most basic form. These solutions that lead to development tend to take the form of new attitudes, new technologies, or new methods for doing something. These factors may also be referred to as innovations[1].

[1] "An innovation is an idea, practice, or object that is perceived as new by an individual or another unit of adoption" (Rogers 1995: 11).

Innovations may be developed on a local level, by an individual, or a community. The individual or community perceives a problem and comes up with an innovative way for dealing with it. Innovations may also be developed by an organization outside of the area where a problem is being experienced. Development agencies such as the World Bank and the United States Agency for International Development, for instance, have been known to generate innovations in hopes that they will provide a solution for individuals and communities around the world. Innovations are activities/tools used by the development community in an attempt to better the lives of the stakeholders with whom they are working.

Despite the good intentions behind their development, and the benefits they may have to offer, innovations are still frequently difficult to diffuse. Whether they represent a new idea, a new method, or a new technology, innovations will almost always meet with some resistance before becoming widely adopted. Even if the benefits are obvious, potential adopters frequently need time to become more familiar with an innovation and accustomed to the idea that it may require a change in the way they operate before deciding whether or not to adopt it (Rogers 1995). Those interested in understanding the diffusion of innovations have, as a result, invested a significant amount of time over the years in researching and developing means for making the diffusion process more efficient.

One such means is the demonstration. Research and practice have shown that successful demonstration projects speed diffusion rates by increasing an innovation's observability, or "the degree to which the results of an innovation are visible to others" (Rogers 1995: 16), and generating information about how well the innovation operates

under field conditions (Magill and Rogers 1981). Improving the observability of the innovation and increasing the amount of available information about it acts to reduce any uncertainty a potential adopter may have about an innovation, thereby increasing the chances the innovation will be adopted and diffused (Baer et al. 1977).

Research and practice have also shown, however, that demonstrations are not always successful and often fail to meet their objectives (Baer et al. 1976, 1977). These demonstrations generally suffer from at least one of three main problems: they are unable to increase the innovation's observability; do not provide enough information about an innovation to reduce the uncertainty of its potential adopters; or make the innovation too observable and make too much information available while the innovation is still in a testing phase and has yet to be proven (Dearing 1997). These problems result in low adoption rates and can at times slow the diffusion of innovations.

The success or failure of a demonstration can be attributed to many different factors, including the process through which the demonstration is implemented. This process dictates how the innovation at the heart of the demonstration will be put to use. While many studies have been devoted recently to researching the process of implementation, most tend to focus on the implementation of an innovation within an organization after the innovation has already been adopted (e.g., Cummings and Mohrman 1987, Nord and Tucker 1987, Tornatzky and Fleischer 1990). Only a few studies have touched specifically on the process of implementation within the context of a demonstration (e.g., Baer et al. 1976).

Problem Statement

Innovations do not diffuse easily. Proponents of innovations, as a consequence, have frequently turned to various alternative methods for speeding the rate of adoption. These methods include demonstration. Successful demonstration projects will speed diffusion rates by increasing the observability of an innovation and showing potential adopters how well an innovation performs in a "real world" setting.

One of the key factors that influence the outcome of a demonstration is the process in which the demonstration is implemented. While there is now a growing literature base on implementation, very little research has been conducted on the process of implementation as it pertains to demonstrations. This study will therefore attempt to expand the understanding of this process by drawing from the implementation experiences of a small-scale wastewater reclamation and reuse demonstration project, Ecoparque[2], in Tijuana, Mexico. Specifically, this study will attempt to build a better understanding of the factors that affect the implementation process of a demonstration.

Research Directions

In order to understand the dynamic processes involved in implementing a demonstration project, this study examines the case of Ecoparque by exploring the following research question:

- How did the demonstration project of Ecoparque evolve as a tool to implement an innovation?

[2] Throughout this thesis, the demonstration will be referred to as Ecoparque. The project, however, did not receive this name until 1993.

In order to answer this question, the following questions guided the research:

- What stakeholder groups were involved in the implementation process?
- What factors were important to the implementation of Ecoparque as a demonstration project?
- How did these factors hinder or facilitate the implementation?

Significance of the Study

This study focuses on the processes involved in the implementation of a demonstration project. Understanding these processes will not only add to the growing literature base on demonstration projects; it will also benefit practitioners interested in speeding the adoption and diffusion rates of projects like Ecoparque. The lessons learned during the implementation of Ecoparque will help development practitioners and people interested in wastewater management, in particular, understand that solutions, while deemed viable in the eyes of their developers, may face many unexpected barriers and therefore could be difficult to implement and diffuse.

Overview of the Project

Regional Context

Tijuana is one of the fastest growing areas in Mexico. Located just south of San Diego, California, on the United States/Mexico border (see Figure 1), people from all over Mexico have migrated to Tijuana for one of two main reasons. First and foremost,

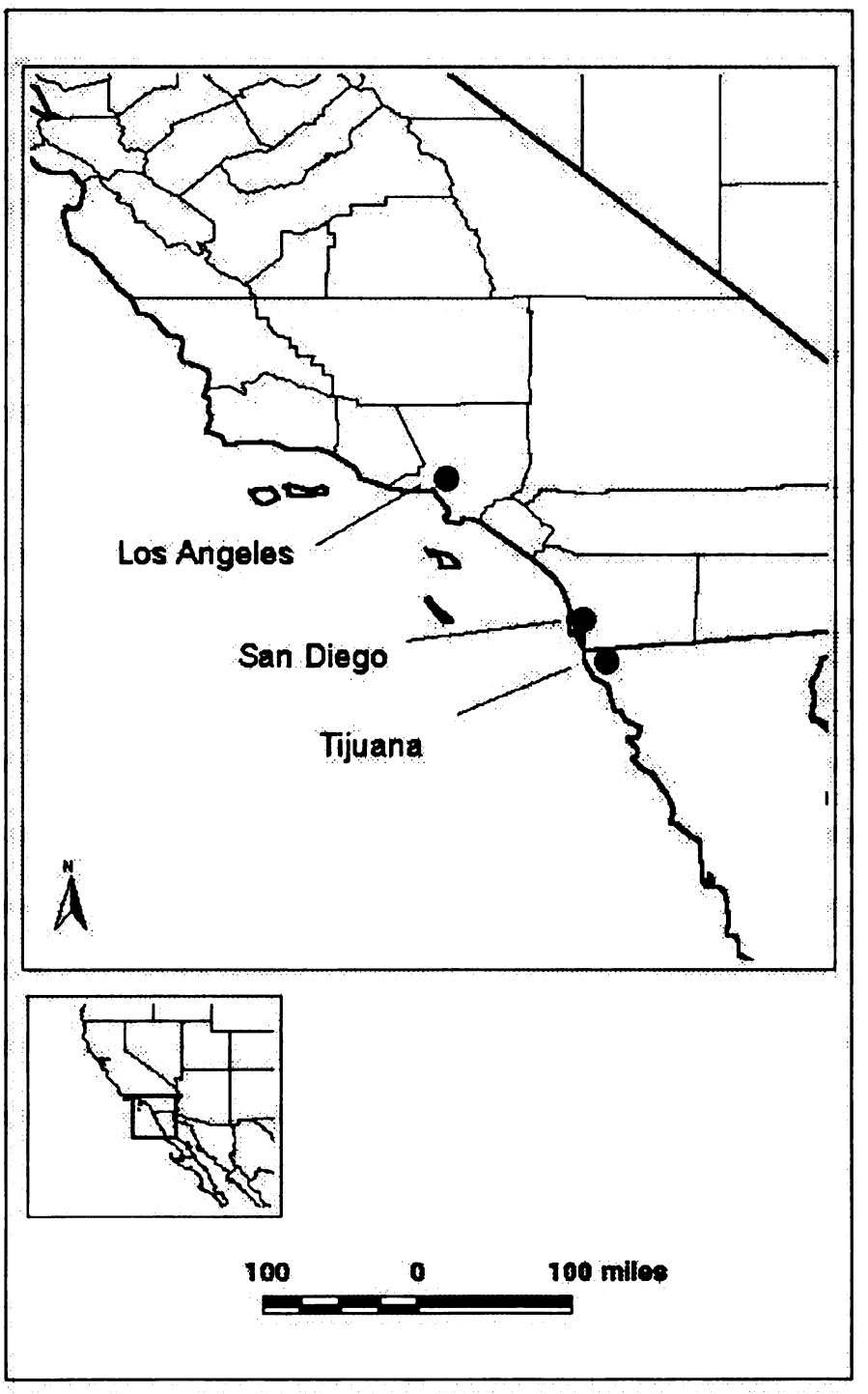

Figure 1. Map of San Diego/Tijuana Region.

there are numerous employment opportunities in the city's many *maquiladoras*[3]. Secondly, Tijuana is an important crossing ground for people interested in finding high paying jobs in the United States, relative to what they can make in Mexico. Annual population growth rates in Tijuana have increased from 3.0% in the 1970's to 4.9% in the 1980's, and present estimates indicate that these rates have risen even higher in the 1990's (Ganster 1999). This is well above the 2.0% national average growth rate (SAHOPE and COSAE 1994).

The growth in Tijuana has not come without a cost. While there may be more business and/or employment opportunities, de la Parra and Luecke (1997: 2) explain how, "as a result of this demographic explosion, the urban infrastructure, including the water and sewage systems, has been overwhelmed". The treatment of wastewater, in particular, has been a problem for many years now. Even with the upgrades the city has made to the system over the past couple of decades, including the newly constructed International Wastewater Treatment Plant (IWTP)[4], wastewater treatment is still inadequate. Salazar (1999) reports that the sewage system in Tijuana presently services around 65 percent of the city's population. Raw sewage continues to flow into the Tijuana River, contaminating the Tijuana River Valley, and threatening the health of the Tijuana River

[3] Large industrial plants that have moved to the Mexican side of the U.S.-Mexico border from the United States, Canada, Europe, and Asia in order to take advantage of cheap labor and tax exemptions and still be close to United States markets.

[4] The International Wastewater Treatment Plant, which had an initial estimated cost of $400 million, officially began operations in April 1997. The plant is located directly across the border from Tijuana and is projected to treat 25 millions gallons per day of raw sewage. Effluent treated at the IWTP is discharged into the Pacific Ocean.

National Estuarine Research Reserve[5] and other sensitive coastal waters of the region (Salazar 1999).

Project Description

Ecoparque is a demonstration project that has been run since 1991 by *El Colegio de la Frontera Norte* (COLEF), a local research institution. Located on steep hillside in the heart of Tijuana (see Figure 2), Ecoparque uses a small-scale wastewater treatment system to reclaim household wastewater from an adjacent residential neighborhood and reuse it for irrigation. In conventional systems, wastewater effluent is typically collected, treated thoroughly, and then discharged into a water body, such as a river or ocean, without consideration for its future value. Ecoparque's wastewater reclamation and reuse program models an alternative approach. Wastewater effluent is collected, brought to a treatment center, treated partially or completely, and then released for reuse at a designated location either on-or off-site. Wastewater, therefore, becomes a resource rather than just another problem to be pumped away (de la Parra 1989).

Over the past eight years, Ecoparque has demonstrated that its low cost and simple wastewater reclamation and reuse technology can effectively treat wastewater and, at the same time, create a new source of water. As a result, it has also shown that Tijuana has alternatives for addressing its water and wastewater problems. By building a system of inexpensive, small-scale projects like Ecoparque around the city, the people at Ecoparque feel that Tijuana would enhance its treatment capacity and make a new source of water available for something beneficial, such as developing more urban green space.

[5] The reserve is a saltwater marsh ecosystem located south of San Diego, on the United States side of the border, at the mouth of the Tijuana River.

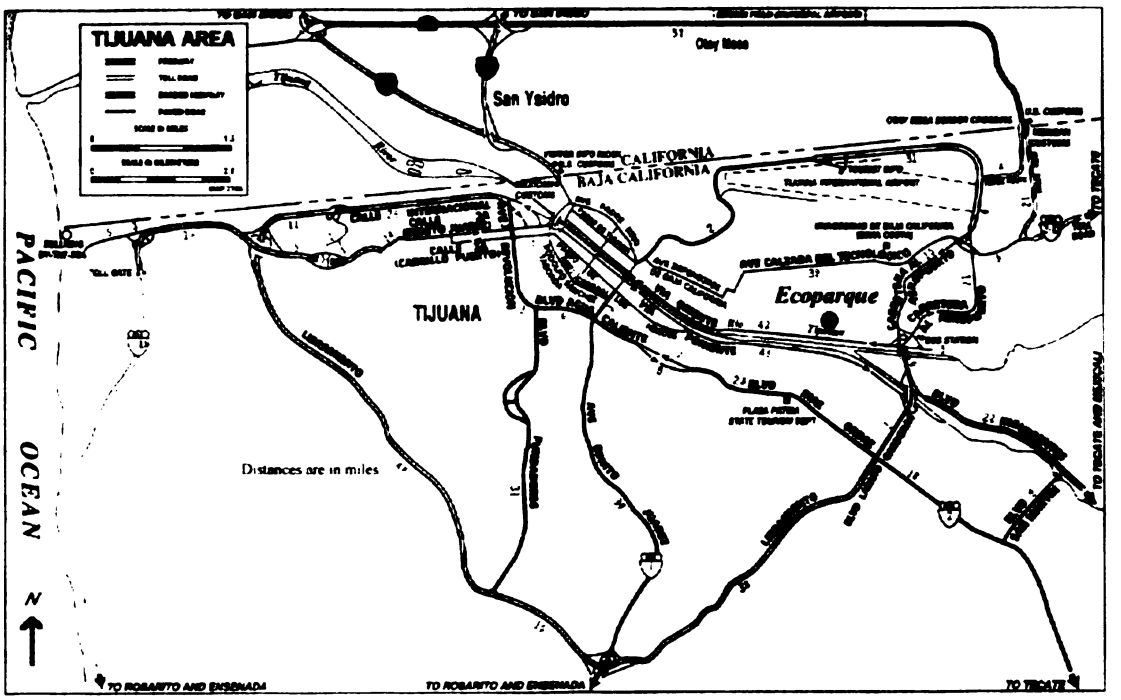

Figure 2. Detail of Tijuana indicating location of Ecoparque (adapted from Estero Beach Volleyball 2000).

Over that same period of time, Ecoparque has developed into more than just a wastewater reclamation and reuse system. The project is now not only a place where researchers explore alternative technologies for treating wastewater. It is also a place where the surrounding community can come and learn more about issues such as composting, urban forestry, and bio-diversity. Thousands of people visit the project each year to take a tour or just to get away and relax in one of Tijuana's few remaining green spaces. Ecoparque has become a symbol for what can be accomplished if waste is thought of as being a resource rather than just something to be thrown away. As one

former project director said, "There are very few people that will go there, look at it, see what's going on, and not come out and say, this has got real potential."[6]

Organization of the Study

This study will be organized in the following manner: The next chapter will be a literature review. The third chapter will be an outline of this study's research design. The fourth chapter provides a detailed description of Ecoparque's implementation. Chapter five will include a discussion of the research results and analysis of the results using concepts borrowed from existing literature, that address the research questions. The sixth and final chapter contains a study summary, some conclusions, and a set of recommendations for future studies.

[6] All uncited quotes are taken from interviews conducted for this research.

Chapter 2

Literature Review

Introduction

This chapter presents concepts from literature on qualitative research, diffusion of innovations, demonstration, innovation implementation, and wastewater reclamation and reuse. The literature review on qualitative research will cover what types of problems warrant the qualitative approach, some assumptions of the approach, and the types of research tools typically used in qualitative studies. Using diffusion of innovations as a general background, the literature bases of demonstration, innovation implementation, and wastewater reclamation and reuse are crucial to the understanding of the details of this study. The literature helps frame the research problem discussed at the beginning of the study and contributes to the construction of a broader final analysis of emergent themes and categories (Creswell 1994).

Qualitative Research

Creswell (1998) emphasizes the fundamental decision to engage in qualitative research lies in the type of problem being examined. Merriam (1988, as cited in Creswell 1994) notes that a qualitative approach to research is the most appropriate when examining a process. Also, qualitative studies are exploratory in nature (Creswell 1998) because not much is known, whether it be variables that cannot be clearly defined or inadequate theory to explain people's behavior. Also, Creswell (1994) points to a basic

assumption that reality is viewed differently from the perspectives of different people, therefore is subjective.

When accepting this assumption, methodological assumptions are then made about qualitative research. Marshall and Rossman (1995:44) say that "the strengths of qualitative studies should be demonstrated for research that is exploratory or descriptive and that stresses the importance of context, setting, and the participants' frames of reference." Therefore, contextual elements and the setting are described in detail. The researcher also seeks to understand people's backgrounds and roles in the situation in order to understand their interpretation of events.

In order to explore people's multiple view of reality and the context in which people operate, then richly describe the situation examined to understand a particular problem, qualitative researchers use a variety of tools. Creswell (1994, 1998) and Miles and Huberman (1994) detail qualitative research strategies such as case studies, ethnographies, and grounded theory. Actual data collection methods for each of these strategies also vary. Denzin and Lincoln (1994), for example, go into great detail on methods such as interviews, observations, and document review.

The choice to use a particular strategy depends on the problem being examined. Creswell (1998), Stake (1994), and Yin (1994) discuss case studies specifically. A case study is appropriate to examine a situation that is bounded by time and location. A case study examines what is unique about a situation and what can be learned from that uniqueness. Once a strategy is chosen, that strategy lends itself to particular data collection tools. Again, Creswell (1998), Stake (1994), and Yin (1994) examine the tools suited for case studies. Multiple sources of information are used to construct a case,

therefore a combination of tools such as interviews, documents, and observations are used. Not only does using different tools help broaden the researcher's understanding of multiple perspectives, but it assists in triangulation (Stake 1994), which assists the researcher in meeting an "expectation that the meanings of situation, observation, reporting, and reading will have a certain correspondence." (Stake 1994:241). Triangulation can be done through multiple tools as well as multiple sources of information using a particular tool (Mukgerjee 1995) – interviewing different stakeholders, for instance.

Diffusion of Innovations

Studies on the diffusion of innovations have been conducted for years now by researchers from many different scientific disciplines. Recently, however, this research has converged into a "single, integrated body of concepts and generalizations" (Rogers 1995: 94). Of these concepts, the one most relevant to the case discussed in this thesis is the Innovation-Development process.

Rogers (1995) describes the Innovation-Development process as a series of stages from the emergence of an idea to solve a particular need, to the creation of an innovation, to the impact of that innovation once adopted or rejected. The specific stages are explained below.

Stage 1. Identifying a need or problem.

Stage 2. Researching potential solutions/innovations.

Stage 3. Developing the innovation to meet the need or problem.

Stage 4. Converting (producing, packaging, marketing, etc.) the innovation into a useful product for widespread distribution.

Stage 5. Diffusing the innovation and the target audience adopting or rejecting the innovation for use to meet the need or problem.

Stage 6. Changing of a person or group as a result of the adoption/rejection of the innovation.

Although these stages are somewhat arbitrary in that they do not always occur in the same order for every innovation (Rogers 1995), they do help establish a context for the subject of the following section of this review: the demonstration. Demonstrations are often used sometime between Stages 3 or 4 as a final stage of the scaling-up process, from research and development to widespread use (Baer et al. 1977), to help speed the diffusion of an innovation.

Demonstration

There are two categories of demonstrations: experimental and exemplary (Rogers 1995, Magill and Rogers 1981, Myers 1978). Exemplary demonstrations are typically conducted to accomplish two objectives. The first is to increase the observability (Rogers 1995) of an innovation. By putting an innovation on display, demonstrations permit potential adopters to see how well it operates under actual field conditions (Magill and Rogers 1981). The second objective is to produce new and disseminate already existing information about the innovation. Both objectives combine to reduce the uncertainty a potential adopter may have about an innovation and thereby increase the chances the innovation will be adopted and diffused (Baer et al. 1977).

Within the context of the diffusion of innovations, uncertainty generally refers to the degree of knowledge someone has about an innovation prior to its adoption and implementation. Exactly how much is known depends on how well the innovation is defined, how well steps have been outlined for implementing the innovation, and how easy it is to learn how to use the innovation. Innovations that do well in each of these categories are considered to be highly certain. Innovations that do not do well, on the other hand, are considered to be highly uncertain. As uncertainty rises, adoption rates fall and the process of implementation becomes more complex (Cummings and Mohrman 1987).

Experimental demonstrations are conducted primarily to test, evaluate, and further develop an innovation (Magill and Rogers 1981). The uncertainty about how the innovation will perform under operational conditions is high. Therefore, visibility is kept to a minimum and access is restricted to the sponsors of the innovation until a relatively high degree of certainty can be expected by potential adopters (Myers 1978).

Research has shown that these two types of demonstration are often confused and consequentially, certain demonstration projects have taken on characteristics of both experimental and exemplary demonstrations (Rogers 1995). Dearing (1997) suggests that this confusion tends to lead to demonstration failure (the main objectives are not accomplished) and that demonstration advocates should know to distinguish between the two when they design a project.

The decision to conduct an experimental or exemplary demonstration is only one of many important decisions made during the process of demonstration planning and implementation. Baer et al (1976), in their study of 24 federally funded demonstration

projects, identify five additional aspects of planning and implementation that are important to project success. They recommend:

1. Including the target audience in planning processes.
2. Making planning and implementation decisions locally.
3. Involving private sector firms with incentives to become manufacturers and suppliers of the innovation.
4. Defining site characteristics early in the planning process.
5. Planning and implementing a demonstration at a scale large enough to provide sufficient data for full-scale operation.

Wastewater Reclamation and Reuse

The process of wastewater reclamation and reuse is one where we can understand more about issues of implementation. While most literature sources on wastewater reclamation and reuse have a tendency to focus on technical issues related to system efficiency, there a few reports that deal with project planning and implementation (e.g. Uhlmann and Luxford 1999, Mills and Asano 1998, Wegner-Gwidt 1998). These reports highlight the barriers wastewater reclamation and reuse projects have faced in the past and recommend strategies for avoiding them in the future.

One of the biggest barriers these projects have encountered is public perception. Uhlmann and Luxford (1999) found that the public is generally uncertain about the type of technology used to reclaim and reuse wastewater, are unwilling to have operations close to home, have concerns about health standards, and are concerned the cost of their water services will change. Venhuizen (1991) also found that people are particularly

reluctant to give consideration to alternatives to conventional water services. There is a resistance to change.

Wegner-Gwidt (1998) suggests that the first step to overcoming resistance to change is to establish a line of communication with the public and address the perceptions and expectations of community members, special interest groups, government agencies, and the media. This will:

1. Inform and educate the public.
2. Present important issues early and avoid any unnecessary surprises.
3. Identify sources of opposition and their main concerns.
4. Encourage public input.

This will also, according literature on innovation implementation, make these groups more accepting (Johnson and Rice 1987, Locke and Schweiger 1979) and more committed to the project (Markus 1983).

In order to avoid other kinds of barriers facing wastewater reclamation and reuse projects, Mills and Asano (1998) recommend conducting feasibility studies early in the planning and implementation process. These studies, based on criteria such as engineering, economic and institutional feasibility, will help project managers anticipate potential barriers and assess if they can be overcome.

Implementation

If potential adopters of an innovation are likely to fully understand it and do not consider its adoption much of a risk, i.e. they consider it a highly certain innovation, much of the implementation process can be pre-planned and standardized (Cummings

and Mohrman 1987). Employing strategies, like the ones presented above by Baer et al (1976), will help make this process run as smoothly as possible. There have been instances, however, when people have chosen to follow some of the most accepted implementation strategies and still failed to implement an innovation (Leonard-Barton 1988b). Cummings and Mohrman (1987) propose, therefore, that there must be a degree of latitude included in planning implementation, whether an innovation is certain or not.

Planners and managers must be aware that implementation is not a predictable realization of a programmed plan. Instead, implementation is a dynamic process of *mutual adaptation* between an innovation and its "user environment" (Leonard-Barton 1988a), where innovations not only adapt to the existing environment they also change the structure and practice of the environment itself (Van de Ven 1986).

Diffusion literature commonly refers to this process of adaptation as re-invention (Rogers 1995, Johnson and Rice 1987, Rice and Rogers 1980). This concept, however, only focuses on the degree to which an innovation is altered or modified by a user to suit his or her needs (Rogers 1995, Leonard-Barton 1988a, Rice and Rogers 1980). Leonard-Barton (1988a) argues that the environment is also impacted simultaneously by the innovation and goes through a process of re-invention as well.

Managers who are able to be flexible and direct implementation as a process of mutual adaptation are likely to be more successful at implementing the innovation, because the innovation and its environment will have changed sufficiently to make a more appropriate fit (Leonard-Barton 1988a).

Chapter 3

Research Methods

Introduction

This chapter is divided into five different sections, each describing a step taken to complete the research for this case study. The first section introduces the two types of data this study draws from and explains why they were used. The following section details how the sources for these two types of data were located and accessed. The third section describes how the data was actually collected in the field. The fourth section explains how the data was manipulated and analyzed. Lastly, the final section describes what methods were used to verify the validity of the data presented in this study.

The Use of Qualitative Approach

The research methods used for this case study were chosen for their qualitative nature. This decision was based on the literature discussed in Chapter 2: the qualitative approach was appropriate for this study because it examined the *process* by which a demonstration was implemented, this process was understood through the *subjective perspectives* of reality from multiple players, and these perspectives were examined in light of the *context, setting, and people's frames of reference*. This approach allowed the researcher to meet people who knew about Ecoparque and its implementation in their natural setting, to explore the project's history through their perspectives, and therefore reconstruct a detailed, multiple perspective view of what actually happened. The

research design was flexible, which left the study open for emergent issues or themes as they developed in the field.

Types of Data Used

This study used two forms of data. The first and primary source of data was open-ended, semi-structured interviews. This type of interview was chosen primarily because a researcher can use it to "ask key respondents for the facts of a matter as well as for the respondents' opinions about the events" (Yin 1994: 84). Open-ended, semi-structured interviews also opened the study to what Stake (1995: 64) calls the "road to multiple realities" and gives interviewees the freedom to provide information on topics not previously considered by the researcher. Having each of these characteristics in an interview was necessary, especially considering very little was known to the researcher of Ecoparque and its implementation prior to beginning the research.

The second kind of data came from archival research. This included written documents such as project proposals, e-mails, official statements, and news articles. Information from these sources was used to corroborate or contrast with information collected in interviews. This information also "allows an investigator to address a broader range of historical, attitudinal, and behavioral issues" (Yin 1994:92) beyond those that emerge in the interviews.

Identifying Sources of Data

The research process for this case study started with the identification of potential interviewees. These were people who had been involved with the project during its

implementation, public officials who had an influence on the project's progress, local researchers, and local environmental activists.

The process of identification began with help from gatekeepers (Creswell 1998). These gatekeepers were individuals who had either been involved with the project or were familiar with it. They were therefore able to assist the researcher to gain access to other key individuals who had different perspectives about the case. Two gatekeepers at the beginning of the study were asked to provide a list of potential interviewees and, if available, their contact information. This list became a springboard for the remaining research. Through snowball sampling (Miles and Huberman 1994), which involves pursuing sources provided by each subsequent contact person, the list of contacts grew throughout the research period.

A similar strategy was taken with archival research. While the gatekeepers helped identify and locate some relevant documentation, more written information was identified by other contacts and located as the research progressed.

Data Collection

Arranging an Interview

Interviews were generally arranged by telephone or e-mail. When potential interviewees were contacted, they were introduced to the researcher, provided with a summary of this research, and ultimately asked if he/she would be willing to participate in an interview. If the potential interviewee agreed to participate, he/she was asked to set a time and place to meet for the interview.

Some interviews, however, were arranged with help from former interviewees. They were either able to obtain access to potential interviewees who had proved to be unreachable by telephone or e-mail, or, on a few occasions, they introduced the researcher to a colleague[1] whom they thought might have a different perspective on the project directly after their interview had been completed.

Conducting the Interview

At the beginning of each interview, the interviewee was re-briefed on the nature of the research. Afterwards, the interviewee was read a consent form (see Appendix I), which explained who would be conducting the research, the purpose of the research, and how the rights of participants in the research would be protected[2]. The interviewee then signed his/her name on the consent form to indicate he/she understood the nature of the research and agreed to be interviewed. The interviewee was also asked to initial the consent form if he/she was willing to have the interview taped[3].

At the beginning of the interview the interviewee normally took the initiative and began telling his/her story. For people who had been directly affiliated with the project, their stories often began by explaining how they had been introduced to it. For people who were not affiliated with the project or had not participated in its implementation, their stories started with information on how they first heard about it.

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[1] This was generally a co-worker or professional acquaintance who happened to be in the same office.

[2] This study received approval from the Michigan State University Internal Review Board for research involving human subjects (IRB# 99-329).

[3] 12 interviews were not recorded because the researcher felt recording would be inappropriate at the time or the interviewee declined to enter his/her initials on the consent form.

As the interview between researcher and interviewee proceeded, however, the researcher gradually directed the conversation around a list of pre-prepared questions.

These questions were organized prior to traveling to the research site and can be found in Appendix II; developed according to interview protocol guidelines in Creswell (1994). The questions were used as points of departure, addressing what the interviewee's professional role is/was in relation to Ecoparque (questions 1 and 2 of protocol), what the interviewee perceived to be as the goal(s) of Ecoparque (questions 3 and 4), who was involved in Ecoparque's development and implementation (questions 5-7), how Ecoparque was developed and implemented over time and why (questions 8-11), and what, from the interviewee's point of view, the main factors were that affected the implementation process (questions 12-17). The answers from these questions would ultimately be used to build a better understanding of the factors that affected the implementation process of Ecoparque.

During the fieldwork, these questions were appropriate for interviews with people who had participated in the project's development and implementation. However, they were not well suited for interviews with people who had not. Therefore, the questions asked during these interviews were adapted to center on the interviewees' knowledge of the project and their perception of how the project fit in the surrounding border environment.

For some interviewees, the actions and events critical to the implementation of Ecoparque were not fresh in his/her memories. If, during the course of the interview, they neglected to give their perspective on some of these actions and events, they were prompted to do so. The researcher, for example, would ask the interviewee if he/she

remembered a specific event. The researcher, however, prompted with discretion, and only asked questions about well-known actions and events. The researcher also attempted to allow each interviewee to talk with the least amount of interruptions as possible.

In all, twenty-five one-on-one interviews were conducted between July and August of 1999. Fifteen of these interviews took place in the United States, eight occurred in Mexico, and two were done over the telephone. They were conducted by the researcher, either in English or Spanish, depending on which language the interviewee preferred.

Data Analysis

Data analysis for this study revolved around what Yin (1994: 110) calls "explanation building". After the data was collected, it was interpreted, reduced, and entered into a running narrative that pieced together different perspectives and events, thereby creating a clearer picture of the case than would have emerged from one or two sources. By going through each of these steps, general themes emerged from the data to help advance a basic understanding of the process of demonstration project implementation.

Data interpretation began with the transcription of taped interviews. This process took place as soon as possible after the interviews had been conducted. As the interviews were transcribed, the researcher made notes in the margins of the transcriptions. These notes, containing thoughts and comments, were used as flags for the researcher as the

data was reviewed in full a second time. They signaled points of departure that had the potential to develop into major themes for the study.

For those interviews that were not taped, interpretation meant re-writing the written notes. Re-writing the interviews immediately after they were conducted helped the researcher capture some elements of the interview that were lost while taking notes. Re-writing also gave the researcher time to make note of important themes emerging in the interviews.

The data from these transcriptions or re-writes were aggregated (Stake 1995) into various categories. Aggregation involved extracting comments from the data and grouping them according to the issue to which they pertained. Comments about barriers, for instance, were placed into a category about barriers and then that category was subdivided depending on what kind of barriers was being discussed. Similarly, comments about the support people who worked on Ecoparque received during the process of implementation were grouped and then subdivided according to the type of support being discussed. The researcher sought to collect related comments from the data with the hope that "issue relevant meanings" would emerge (Creswell 1998: 154).

Some of these categories focused on the roles and motivations of major stakeholders in the case. This information was used to develop a description of the case including a chronological timeline of project implementation facts and events, which is found in the following chapter. Other categories dealt with the project's evolution. These will emerge in chapter five as the author attempts to discuss the major themes of this case study. The last group of categories formed the foundation of the thesis' final

chapter, where recommendations are made for the planning and implementation of future projects.

Verification of Results

Two main methods were used to verify the quality of information generated in this case study. The first of these methods is called triangulation, the "convergence of multiple sources of evidence" (Yin 1994: 93). Being able to corroborate and contrast data between both interviews and documentation, the researcher converged on themes or perspectives that appeared to more accurately represent what actually happened during Ecoparque's implementation.

The second method used in this study is called member checking (Creswell 1998, Miles and Hubermann 1994). In this process "the researcher solicits informants' views of the credibility of the findings and interpretations" (Creswell 1998: 202). To "ensure the truth value of the data" (Miller 1992, as cited in Creswell 1994: 167), two interviewees who had expressed interest in helping with the study were asked to review and comment on portions of this thesis' Case Description and Discussion of Results.

Chapter 4

The Implementation of Ecoparque

Introduction

This chapter provides a detailed description of Ecoparque's development and implementation. The chronological review of major events begins with the birth of Ecoparque in the United States in 1983 and ends with its final implementation in Mexico in 1991. This chronology is divided into two phases: the experimental phase and the exemplary phase. A list of key players in the development and implementation of both phases are detailed in Table 1. A timeline for both phases can be found in Appendix III.

Phase 1: The Experimental Phase 1983-1986

1983

In 1983, a group of concerned U.S. citizens living around San Diego, U.S., began discussing how to address the water quality problems of the Tijuana River. For years, sewage[1] had been running out of Tijuana, through the Tijuana River, and polluting sensitive coastal waters along the border, including the newly created Tijuana River National Estuarine Research Reserve. The group thought that if they could not find a method for controlling this flow of water, the health of the Reserve and local beaches would be put in jeopardy.

[1] de la Parra and Luecke (1997) report that as much as 4 to 5 million gallons of raw sewage crossed the border each day.

Table 1. Key Players in Ecoparque Implementation Process.

Key Players	Description.
California State Coastal Conservancy	The state agency responsible for creating the Tijuana River National Estuarine Research Reserve.
Southwest Wetlands Interpretive Association (SWIA)	The non-profit organization located in Imperial Beach, California.
Environmental Defense Fund (EDF)	An environmental non-governmental organization based in the United States.
El Colegio de la Frontera Norte (COLEF)	A research institution located in Tijuana.
Technology Innovators	Two PhDs who developed the core technology used at the demonstration project.
Project Manager	A consultant hired by SWIA and later retained by EDF to run the demonstration project.
Project Engineer	A consultant hired by SWIA and later retained by EDF to test the project technology.
Members of SWIA	Community members of Imperial Beach, California.
Project Foreman	A contractor hired by the EDF to help expand the demonstration.
President of COLEF	Head of the research institute.
International Boundary and Water Commission (IBWC)	The United States branch of a bi-national governmental organization responsible for managing waterways between Mexico and the United States.
La Comisión Internacional de Limites y Aguas (CILA)	The Mexican branch of a bi-national governmental organization responsible for managing waterways between Mexico and the United States.
La Secretaria del Desarollo Urbano y Ecologia (SEDUE)	A branch of the Mexican government in charge of urban development and ecology.
La Promotora del Desarollo Urbano de Tijuana, S.A. (PRODUTSA)	A branch of the Mexican government in charge of promoting urban development in Tijuana, Mexico.
Institute for Regional Studies of the Californias	A research institute at San Diego State University (SDSU)

The group of citizens ultimately decided that the key to solving the wastewater problem was to develop a sewage treatment process that could treat sewage at its source. Most wastewater treatment systems at the time were designed to collect wastewater at its source and then pump it to a central wastewater treatment plant. These conventional systems, however, failed to provide adequate treatment when the system did not reach all the areas where sewage was being generated.

This was the case in Tijuana. A significant amount of the wastewater crossing the border came from Tijuana's steep hillsides and canyons, where recent immigrants to the city were building new settlements (see Figure 3) at a faster rate than for which the city sewer system could account. As de la Parra and Luecke explain (1997: 3), "Sewage interceptors quickly became overloaded in these areas, and the canyons themselves became wastewater canals."

In the meantime, two PhDs from the University of California at Santa Barbara had been exploring low-scale technological alternatives to wastewater treatment and were considering the idea of testing their plans through a pilot project. The technology involved three main components: a stainless steel screen to separate solids from the water, a PVC "biofilter" where naturally occurring bacteria grow on the plastic and digest the organic wastes as the water trickles over the filter, and a "clarifier," in which remaining solids settle out of the water.

Figure 3. Tijuana settlement on hillside (Photograph by R. Angiano; used with permission).

These technology innovators and the citizen group met and agreed that the technology could serve as a foundation for a project that would address at least some of the concerns over water quality in the Tijuana River watershed. In particular, the treatment technology would be adaptable to Tijuana's steep hills and canyons, where the city could not easily expand their sewer system.

Armed with new ideas and a new technology, the group of citizens called a meeting. They contacted different stakeholder groups from the region and asked them to come to discuss different solutions to the area's wastewater problems. One of the organizations that came to the June 1983 meeting was the California State Coastal Conservancy, who had been responsible for the development of the Tijuana River

National Estuarine Reserve. The Coastal Conservancy was also interested in discussing any ideas that could help protect the Reserve.

A few months after the meeting, the Coastal Conservancy asked the Southwest Wetlands Interpretive Association (SWIA), a non-profit environmental group based in Imperial Beach, California, to explore inexpensive solutions to water quality problems in the Tijuana River National Estuarine Research Reserve. SWIA members had been active at the June 1983 meeting and had worked with the Coastal Conservancy to establish the Reserve a few years earlier.

1984

In 1984, SWIA sent the Coastal Conservancy a report which "recommended the trial of a treatment system based on simplicity of operation but designed to treat concentrated wastewater efficiently" (de Treville 1984, quoted in de la Parra and Luecke 1997: 8). Through testing this system, composed of a stainless steel screen, a corrugated plastic media biological filter, and a settling tank, SWIA hoped to demonstrate an alternative sewage treatment process that would:

- Treat and reclaim wastewater
- Be adaptable
- Work on gravity to conserve energy
- Help reduce the number of renegade flows[2]
- Pay for itself
- Enhance biodiversity

[2] Wastewater flows generated in the canyons of Tijuana, which were not captured by the city sewage collection system.

The ultimate goal of this treatment process was to enhance and protect the Tijuana River and the Estuarine Reserve.

In July of 1984, the Coastal Conservancy agreed to fund a demonstration project where the technology SWIA had recommended could be tested. Once the Coastal Conservancy had accepted its proposal, SWIA set out to find a site for the demonstration. SWIA found a site for the project on the United States side of the border, located in the Tijuana River Valley on Dairy Mart Road. The property, which was leased by the International Boundary and Water Commission (IBWC), was selected mainly for its proximity to the emergency connection[3]. The connection would provide a source of Mexican wastewater that SWIA could use in the system.

Another one of SWIA's main goals was to bring a bi-national element to the project. Since Tijuana's wastewater problem effected both sides of the border, SWIA thought the project would benefit from having people from both Mexico and the United States working on the project. Therefore, SWIA hired a group of consultants from Mexico and the United States to form a project team and help run operations.

One of these consultants had been working on the project with SWIA from the very beginning. She had written the proposal to the Coastal Conservancy, she had found the site for the facility, and she had introduced SWIA to nearly everyone who was working on the project. SWIA asked her to be the project manager.

Another of the consultants came from a research institution in Tijuana called the *Colegio de la Frontera Norte*. He had met the project manager while working for an

[3] A sewer line designed by the IBWC in 1965 to transport 13mgd of wastewater from Tijuana to San Diego for treatment at the Point Loma facility.

agency in charge of water in Mexico and was interested in exploring alternative technologies for wastewater treatment. SWIA asked him to be the project engineer.

With his connections in Tijuana's government, the project engineer began what he referred to as the "Mexicanization" of the project. He began talking to people he knew in the government, trying to persuade them that the ideas presented in the pilot project were legitimate, that the project was not just another idea the "gringos" (or Americans) wanted to force on Mexico, and that the city could actually benefit from using the innovative technology.

1985

By 1985, all the components were in place. SWIA had been able to secure money from the Coastal Conservancy, to find a site for the pilot project, and to draft plans for a temporary facility. SWIA started construction at the Dairy Mart Road site in March 1985.

The construction was finished by June and wastewater, drawn from the emergency connection, ran through the facility for the first time. From June until August, project team members tested each stage of the treatment train. They ran wastewater through the stainless steel screen, the plastic biological filter, and the settling tanks, examining how the biochemical oxygen demand (BOD) and total suspended solids (TSS) in the water changed at each stage of the treatment process. Both of these measures help assess the quality of the water; the lower the measures the cleaner the water. After they

were satisfied with the results[4], they let the wastewater run through the entire treatment system 24 hours a day, 7 days a week.

For the next nine months, everything ran very smoothly at the pilot facility. The project engineer visited the facility regularly to monitor water quality levels. A group of volunteers from the community organized a schedule for general maintenance. There was even a small dedication ceremony towards the end of the year. The project was an experimental demonstration at this stage.

1986

Operations were running so smoothly by the end of nine months that people at the project started making plans to move the project forward, to be more of an exemplary demonstration while retaining some experimental aspects. This meant expanding the facility and making it more visible to the larger community. To help facilitate this expansion, SWIA decided to turn over control of the project to the Environmental Defense Fund (EDF), a larger organization with more exposure that had more experience running big projects. This move, coupled with the success of the experimental phase of the project, led the Coastal Conservancy to grant additional funding for a second, exemplary phase of the demonstration project in February 1986.

[4] Testing during the first phase of the demonstration revealed that the system treated wastewater at advanced primary levels. Primary treatment, according to Feigin et al. (1991), typically removes coarse organic and inorganic solids, as well as grease and oil. Feigin et al. (1991) describes secondary treatment as involving aerobic and anaerobic biological processes to break down organic material. Advanced primary treatment is, therefore, primary treatment with some elements of secondary treatment. The solids were separated from the wastewater stream using screens and settling tanks and microorganisms living in the biofilter broke down the organic material.

Before any definitive plans for the second phase could be made, however, wastewater suddenly stopped running through the emergency connection. The IBWC and its counterpart in Mexico, *la Comisión Internacional de Limites y Aguas* (CILA: the International Commission for Limits and Water), had agreed to discontinue use of the emergency connection between Tijuana and San Diego. Since the facility could not operate without wastewater, the project manager and the project engineer went to the IBWC and CILA, respectively, to inquire if and when the emergency connection could be used again. While the IBWC told the project manager that the service was only going to be shut down temporarily and that wastewater would run through the emergency connection in a few months, CILA told the project engineer that Tijuana was going to build its own treatment plant and would never send sewage to San Diego again.

Despite the conflicting information, the project manager decided it would be best to listen to the IBWC and begin construction and expand the facility in its experimental capacity. The expanded facility would include wetlands and ponds to treat the water further after it had run through the basic core system, as well as a composting unit to make use of the solids that were separated at the beginning of the treatment process. EDF hired a project foreman and began expanding the facility. Soon afterwards, however, the project faced an even bigger barrier. The IBWC said it would not renew the project's lease and that the facility would have to be broken down and removed from the site.

Phase Two: The Exemplary Phase 1986-1991

1986

The project team tried to find out why the IBWC would not renew the lease. But, after various attempts at communicating with the IBWC, they never arrived at a firm answer. Once they found that the IBWC was not willing to discuss the matter, the project team took steps to override the decision. They consulted with a lawyer to see how they could legally stay on the property. They also spoke with people they knew in other branches of the government. But, despite all their effort, the outcome remained the same. They would have to stop construction, take down their equipment, and put everything in storage.

Finding another suitable location on the United States side of the border for the project proved to be difficult. The sites were often either too far away from an adequate source of sewage or would require using sewage from the United States rather than Mexico. The project team, therefore, decided to search for a new site in Mexico.

For help, the project engineer contacted the president of COLEF. The president was impressed with the project and suggested that the engineer speak with a colleague at *La Secretaría de Desarollo Urbano y Ecología* (SEDUE: the Secretariat of Urban Development and Ecology) in Mexico City.

The project engineer met with the SEDUE contact in Mexico City and presented the project. The contact was impressed with the project as well and urged the project engineer to present the technology to SEDUE's engineers. He said that if the engineers found no problems then two projects could be built, one in Tijuana and one in Ciudad Juarez. The contact also suggested that the project engineer visit an organization called

La Promotora del Desarollo Urbano de Tijuana, S.A. (PRODUTSA: Promoter of Urban Development of Tijuana), a branch of the government which was at the time held property throughout Tijuana.

While the project engineer never received a response from SEDUE's engineers, he was able to find a few potential sites for the project with PRODUTSA. There were three in particular where he thought the project could be located. He presented these three sites at a PRODUTSA board meeting in December 1986 and was awarded one situated on a steep south facing slope just below a neighborhood known as the Colonia Otay Universidad. PRODUTSA drafted an agreement (*comodato*)[5] saying that COLEF, which had become the EDF's partner on the Mexican side of the border, could have the site for five years.

The site was selected for three main reasons. It was located on a steep slope overlooking downtown Tijuana, making it very visible in the community. It was near a city sewer, from which the project could draw and discharge wastewater. And lastly, the 23 acre site would accommodate the disassembled equipment from the first phase of the project.

1987

Finding a new site was only the first step towards completing the second phase of the project. Two additional steps would have to be taken before construction could even

[5] The *comodato* specified that COLEF could only use the land to work on the demonstration project and that it would have to return it in the same condition as it had been before being loaned.

begin at the new site. Project team members would have to make sure they could still use the Coastal Conservancy's money for the project, even though it was now located outside of California, and they would have to find a way to transport the original facility's stored equipment across the border without being required to pay customs.

Making arrangements to use California state money on a project in Tijuana was difficult. Various members of the project team and EDF spent a significant amount of time and money consulting with lawyers to establish that investing California funds in Tijuana was not against the law. But eventually the Attorney General of California signed an agreement stating that since the project would ultimately benefit California, the Coastal Conservancy could fund an out-of-state project.

The process of moving the project's equipment and construction materials across the border was somewhat easier. Contacts at the Institute for Regional Studies of the Californias, at San Diego State University (SDSU), agreed to take all the EDF's equipment and materials as a donation and then transported everything across the border, duty free, as a part of an existing agreement between SDSU and COLEF.

With a new site, funding, and the means for transporting equipment and construction materials, EDF and COLEF began making preparations to build the second phase of the project. They cleared the site, which had previously been an informal community dump, and then began to design how the new facility would operate. The treatment system, which would now include a clarifier, a system of wetlands and ponds, and a composting unit, as well as the core system would have to be adapted to the new site. Construction on the new site officially started in December 1987.

1988

As construction continued, people working closely on the project slowly began to realize that they did not have as much money as they had believed. A large portion of the funding they had received from the Coastal Conservancy had been used on construction at the initial site, legal fees to move the project across the border, and making adaptations at the new site. By the time people really knew how much money remained, it was too late. In March of 1988, with an estimated 75% of the project completed, the EDF stopped construction due to lack of funds.

There was very little advancement on the project over the next three years. The project engineer and the project foreman were able to convince the EDF to permit them to pour concrete at the new site in 1989. Beyond pouring the concrete, however, the EDF had decided not to invest any more money into the project until there was enough to complete construction and write a report for the Coastal Conservancy.

1991

The three years between 1988 to 1991 were very difficult. A number of key contributors to the project resigned their posts, another was fired, and yet another had to leave due to illness[6]. There was even a time when the EDF considered walking away from the project. In the end, however, the EDF and COLEF were able to find the resources[7] to complete construction at the new site.

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[6] The project manager was diagnosed with a brain tumor.

[7] The EDF found funding at the Coastal Conservancy and the General Service Foundation. The project engineer received additional funding from SEDUE, Fundación la Puerta, and the Mexican Council of Science and Technology.

Construction resumed at the new site in January 1991 and was finished in June of the same year. While the original design for the project had included wetlands and polishing ponds, there was not enough money to complete these stages of the treatment process. The final system, therefore, consisted of a stainless-steel fine screen, a plastic media biological filter, a fiberglass clarifier, and a composting unit (see Appendix IV for photographs of each of these components). EDF and COLEF began testing the system in July 1991, using household wastewater from the Colonia Otay Universidad, wastewater has been reclaimed and reused for irrigation at the site ever since[8].

[8] PRODUTSA ultimately gave the property to COLEF. The size of the property, however, was reduced from 23 to 15 acres.

Chapter 5

Barriers and Facilitative Factors in the Implementation Process

Introduction

This chapter synthesizes the academic literature discussed in Chapter 2 and the Ecoparque case study from the previous chapter in order to understand the implementation process of a demonstration project. First, several of the barriers faced in the Ecoparque project are outlined and discussed. This is followed by an analysis of why, despite these barriers, the implementation of the demonstration was successful. The chapter ends with a summary of the factors that facilitated the implementation of Ecoparque.

Barriers to the Implementation of Ecoparque

During the 1983-1991 period detailed in Chapter 4, the various people affiliated with the Ecoparque demonstration project encountered a number of barriers that made the process of implementation difficult. These barriers ranged from an overall resistance to change by a number of parties, to political struggles within the project and from influences without, to different financial problems.

Implicit through many of the interviews and documentation available for the study period, one of the major barriers was a resistance to change. This became apparent through the lack of personal or institutional willingness to support or adopt the new wastewater reclamation technology with no concrete reason for doing so other than the defense of the *status quo*.

When asked what some barriers to the project were, the contractor hired to help build the Tijuana facility noted that one of the main problems the project faced was people's natural tendency to question new ways of doing things when they are different from their experience or training. The current director echoed this observation saying engineers, which make up a large portion of the target audience for this type of technology, "are generally trained in conventional ways and it's hard to show them that there are other ways, that there are alternatives."

A researcher at the University of California at San Diego (UCSD) studying border issues and familiar with Ecoparque's history provided an interesting categorization of people, including those who resisted it's implementation:

> Most reactions to the project fit into two categories. The enthusiastic environmentalists kind, who have a "this is great, this is how it should be done everywhere" sort of attitude. And then the other attitude is one of...at least skepticism, if not outright hostility...and I would divide that group into two. There's a group of people who live in neighborhoods in Tijuana who are skeptical or outright hostile because they don't want a sewage treatment plant in their neighborhood. The other category of sort of skepticism and opposition are really the sort of traditionalists, if you will, who just don't like anything that's new. These are people in CESPT, some of the engineers at IBWC and CILA, some of the government officials in Tijuana, Baja [California] State, and the federal government [of Mexico].

His evaluation included those who welcome change for the sake of any change for what they perceive to be better (the "enthusiastic environmentalists"). He subdivided the parties resisting change into the residents who would be most directly impacted by the change and the institutional power-holders who were invested in maintaining the traditional ways of operating.

This overall resistance to change can be categorized in terms of the specific political and financial barriers that were encountered over time, as developed below.

Political Barriers

The term "political" in this discussion encompasses ideas outlined by Bolman and Deal (1997) such as the development of coalitions of people with similar interests making decisions based on negotiations, and that the distribution and exertion of power is a central concern both within coalitions and between coalitions. The key players who worked on Ecoparque faced political issues both from outside of the group and within the group.

External political pressures

When asked to describe the kinds of barriers Ecoparque faced during its implementation a representative from an environmental NGO based in San Diego, California, suggested that projects like Ecoparque often experience setbacks as a result of the frequent changes that occur in the administration in local state, and federal government. He said that, "While you may have a deal struck with one administration, a new group may come in after only a couple of years and require you to start all over again."

Ecoparque experienced such a setback when the administration changed at the IBWC. According to a former director of SWIA, who had been involved with the project from the beginning, the IBWC was initially very supportive of the project. When the administration changed 1986, however, and a new director was appointed, the support vanished. The IBWC, without warning, told the EDF that it would not renew the lease on

the property where the project had been operating and asked that it stop construction and remove all equipment from the site.

A former official at the IBWC explained that the lease had not been renewed because the IBWC had not been informed of the extent of the project's expansion and was not willing to have constructed wetlands on their property. The IBWC felt the wetlands, located within the Tijuana River floodplain, would be a health hazard to the region.

The director of SWIA at the time suggested that there might have been other reasons. He said that while the original director at the IBWC, who had been in office when the first phase of the project began, was open to alternative technologies, the successive directors were not. He noted that he and the new director "had many bitter disagreements about the way sewage might be treated" and that the new director was only open to conventional ideas for treating wastewater.

The move to Mexico brought other political barriers. One of the main problems the project faced in Mexico was the perception that it was an American project. This was a problem because, as the project engineer explained, "In the political context then, anything that was coming from the U.S. side of the border was viewed as an intervention...it was viewed in an adversarial type of mode." People in Mexico at the time, particularly those in the government, were not receptive to any new ideas coming from the United States because they were tired of the United States telling them how to deal with Mexico's problems.

The project also met some resistance in Mexico because it showcased a technology that would operate contrary to the way government agencies were handling

water issues in Tijuana. Many Mexican officials were not supportive of Ecoparque because it challenged their centralized control over wastewater services. As one former director of Ecoparque said, "We were promoting a concept of [decentralized wastewater management] that would be administered by the citizens, not by the authorities, and they didn't like that". Mexican officials, as a researcher from UCSD mentioned, may have also questioned who would have rights to the all the recycled water generated by Ecoparque or an other future projects like Ecoparque. He said, "All water belongs to the people of Mexico and that right of ownership is exercised by the CNA [*Comisión Nacional del Agua*: the National Water Commission]. And so the CNA...whenever anybody recycles water, shows up and says 'That's ours, we don't have to pay for it because we've never lost title to it. Just because you've cleaned it doesn't mean you get to sell it to us or anybody else'".

Internal political pressures

A number of people who worked on Ecoparque during the process of implementation mentioned that there were internal political problems as well. Foremost among these problems was that, as one consultant suggested, "People lost track of the group ideal and self interest took over." A former director for SWIA added, "You get too many innovative people together working on one project and they lose the goal of what they are trying to do because they all end up trying to go their own way." As people lost sight of some of the original common objectives and became more focused on their own personal motivations, there were conflicts over how to proceed, and the process of implementation slowed down. Power struggles between key players during the second phase of implementation resulted in at least three resignations and, as the chief project

contractor said, "[this] made it hard to get releases of money [for construction] in a timely manner."

Financial Barriers

Within this discussion, financial barriers will be explained in terms of funds available for start-up and operating costs of Ecoparque. For most of the implementation period, funds were not a concern. The Coastal Conservancy provided enough money to finish both phases of the project. The problems began, however, when money that had been meant for start-up and operating costs were spent on unexpected costs, such as moving the project to Mexico. This left less money available for implementing the second phase of the project.

When the initial funding finally ran out, people affiliated with the project were forced to look for additional funding. Over the two years they searched, they found that people were interested in the project but nobody was willing to lend any financial support.

The Mexican government was not interested in investing in Ecoparque. As a former director for the project noted:

> They are dealing with a different way of doing things. They like to build large facilities, long pipe lines, they like to spend a lot of money, they like to contract a lot of contractors, and they like to cut ribbons every other week, and Ecoparque is not that type of project. So it did not fit their expectations.

This statement was confirmed by a representative from one of the Mexican government agencies who admitted that small-scale projects, like Ecoparque were usually not considered.

Other major funding agencies had a similar opinion. The current director at Ecoparque, who is experiencing problems finding funding for maintenance and expansion today, explains how "most funding agencies like the World Bank prefer to be involved with big projects where they have to spend a lot of money on construction and development. They are not interested in smaller and cheaper solutions."

Implementation Strategies Used in Ecoparque

In Chapter 2, a review of implementation and wastewater reclamation/reuse literature indicated some strategies for successful implementation of an innovation. These strategies included increasing community involvement at the initial stages (Wegner-Gwidt 1998, Baer 1976), maintaining decision-making at a local level (Baer 1976), and conducting assessments of project feasibility in terms of economics, engineering, and social and environmental impacts (Mills and Asano 1998). In addition, detailed plans are recommended to guide the implementation process:

> Because the designs of innovations are fully specified, implementation generally involves constructing the innovation from detailed knowledge of its design features and how they should work together. This construction process typically involves specified steps for introducing the innovation into a particular situation which serve as instructions for construction the innovation anew in the organization. They may include aspects as training for organizational members, installation of equipment, establishment of structures and special roles, and the development of communication techniques. (Cummings and Mohrman 1987: 278-9)

Most of these suggested strategies, however, were not followed in the implementation of the Ecoparque demonstration project.

Community Involvement

The community was, to a certain degree, involved with the project during the first phase of implementation. Members from SWIA and other members of the community participated in project activities, such as general maintenance of the treatment facility. Once the second phase began, however, and the project moved to Mexico, community involvement disappeared. CESPT (*Comisión Estatal de Servicios Públicos de Tijuana*: State Commission for Public Services in Tijauna) donated a small labor force and some equipment and a few researchers from COLEF lent their expertise. Beyond that, there was no community input.

A researcher from COLEF explained that the reason why there was no community involvement with the project once it moved to Mexico was that there were not enough managers to teach and supervise anyone not already contributing. The main contractor for the project added that the project team was in such a rush to finish the second phase of implementation and was working with limited funding, that there really was no time to consider involving the community. He said, "We were working six to seven days a week, ten to twelve hours a day, in addition to being stuck at the border at the cross, which is especially bad on the weekends. It would have been difficult to have more community involvement."

Local Decision Making

Decisions regarding the implementation of Ecoparque were largely made at the local level. This was particularly true when SWIA was managing the project. It was located within minutes of the first treatment facility. When the EDF took over control of

the project from SWIA, however, some decision making responsibilities transferred to the their office, located in Boulder, Colorado.

Various interviewees who had been affiliated with the project during the second phase of implementation commented that the distance between the EDF's office and the project site made decision making more difficult. This was true for the EDF office in Boulder, which was in charge of all grant money. The project manager said he had a hard time making decisions because communication with the site in Mexico was restricted to phone calls[1] and mail, and therefore could not stay on top of everything that was going at the project. This was also true for project team members working on-site in Mexico. The project contractor, for instance, felt that if the EDF if had been on-site the internal conflicts between project team members may not have been quite so debilitating. Nearly everyone involved with the project said they thought the second phase of the project would have been smoother if the project had been charged to an office in California rather than Colorado.

Project Planning

If there is an event that exemplified the priority level given to planning the implementation of Ecoparque, it was a meeting held by project team members after the decision had been made to move the demonstration project to Mexico. One of the project consultants described it as follows:

> I had been hammering all along that we needed to have a plan. We needed to have a PERT chart. We needed to have a plan so we knew what everybody was doing and how it all goes together.

[1] There was no phone at the site in Mexico at first. Project team members were forced to go off-site to communicate with the EDF until they obtained a cell phone.

> And...the project engineer didn't want that because it wasn't the Mexican way of doing things. And...the project contractor didn't want it because he's was going to build it. He knew how to build it. He didn't need a plan. He had it in his head...Everybody just said thank you but we don't want to do that.

In essence, nobody on the project team wanted to talk about common visions or set goals and objectives. Everyone had their own objectives and their own ideas for what was best for the project and they were not willing to make compromises. Thus, the second phase of implementation proceeded without a set of goals and objective, without timetables, without periods of evaluation, and even without a plan for how they would build the facility at the new site[2].

Mutual Adaptation

Reviewing the chronology of Ecoparque's implementation, a cyclical pattern is more apparent than a step-by-step pattern. Advances were followed by setbacks, which led to a change in direction from the original plan. Not only did the actual technology change for various reasons, but the organization of people behind implementing the demonstration project changed their own composition and the strategies taken. Leonard-Barton (1988a, 1988b) calls this process "mutual adaptation," where the innovation and the "user environment" simultaneously adapt to one another to reach a better fit (see Figure 4). "Fit" is when the innovation is most successful because both the innovation and the organization in which it is used have become appropriate to one another.

[2] The project contractor explained that while there was a schematic of the various components, there was no actual plan of where the components went on the site.

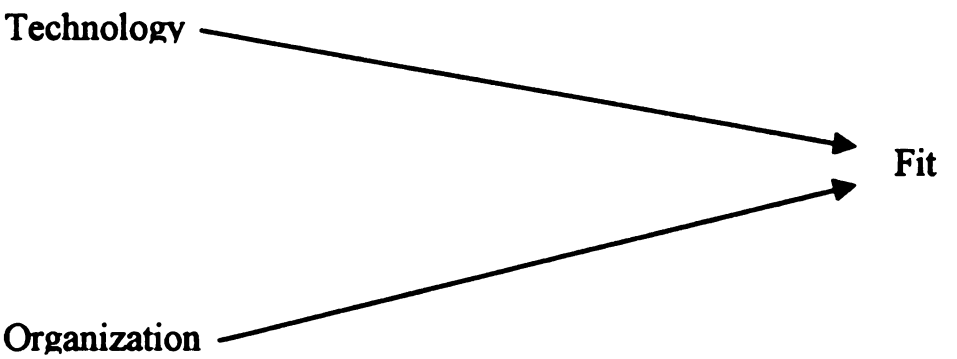

Figure 4. Mutual adaptation (adopted from Leonard-Barton 1988a).

Leonard-Barton's (1988a) term "user environment" is not clearly defined, but she does refer to it in terms of organizations. Therefore, understanding the group of people working to diffuse the technology of Ecoparque as the organization/user environment, a mutual adaptation of the technology and the organization was apparent, as discussed below.

The Technology Adapting to the Organization[3]

At the beginning, the focus of Ecoparque revolved around the technology. People affiliated with the project felt that this unique combination of components could be used to treat renegade flows from Tijuana effectively at a low cost and create green space at the same time. As time went on, however, the scope of the project broadened. After

[3] Though the group of people who worked on Ecoparque were not all of one formal organization, they will be called an organization, referring to the general sense of a group of people collaborating toward a common goal.

meeting their goals for the first phase, the organization of people working on the project decided to run a second phase. Only this time, the facility was to be expanded to include new components such as a clarifier, a system of wetlands and ponds, and a composting unit. These additions, they thought, would improve the level of treatment and therefore make the project more attractive to potential adopters.

The additions made to the technology for the second phase of the project were influenced directly by the interests of the people working on the project. The wetlands, for example, were added to the wastewater treatment system primarily because people on the project, including the project engineer, had worked with wetlands before the project began or simply had an interest in them and hoped to learn more about how they could be used. A representative from the EDF stated that the EDF agreed to become involved with Ecoparque partially because it had been interested in exploring the use of wetlands for wastewater treatment.

The Organization Adapting to the Technology

Just as the technology adapted to the organization of people working on the project, the organization also adapted to the technology. These adaptations were most visible in the change in personnel over time. When they needed someone to help analyze the data they had collected at the first facility and write a report, they asked one of the original innovators to join the project team as a consultant. When they needed someone to help build the new facility with the additional treatment components, they hired a contractor who specialized in working on alternative technologies. And when plans were made to expand the project, the project engineer said, "We needed an organization that could give it a little more humph than SWIA and we got EDF."

The Organization Adapting to the Context

In the case of Ecoparque, the model of the technology and the organization adapting to each other is slightly inadequate. The political, economic, and cultural context in which the events of the case study took place also plays a role. Both the Ecoparque technology and the organization of people who worked on it were influenced by and forced to adapt to the surrounding context.

The organization was forced to adapt, for example, when the IBWC refused to renew the lease on the first site. This event led the organization to move operations to a new site in Mexico and, as a result, forced people who had been working on the project in the United States to adapt to a new setting and a new way of doing things. A Mexican crew helped with the construction of the new facility, construction equipment was borrowed from local government agencies, and most importantly, the EDF formed a partnership with COLEF.

Financial issues also caused changes in the organization. Renewed funding for the second phase from the Coastal Conservancy was contingent upon the sponsorship of a bigger, better known organization than SWIA. The organization, therefore, handed over the control of the project to EDF. Once the Tijuana project began, the organization ran into financial difficulties, making it difficult to meet the salaries of its employees. A number of employees, including the contractor and the consultant, were not paid during the second phase of implementation and until the organization could catch up on the back-pay, some employees volunteered their time in order to complete their responsibilities.

The Technology Adapting to the Context

The surrounding, political, economic, cultural context also had an impact on the technology. One example was the deletion of the final treatment step in the Tijuana site due to lack of funds. After the wastewater was run through the core technology including the clarifier, the plans specified using constructed wetlands and ponds to remove remaining impurities or contaminants. When the organization was not able to finance the completion and integration of these features, it decided that for the immediate purpose of irrigation, the water did not have to be run through the final phase. The completion of the wetlands and ponds was planned for a future time when the appropriate funds were secured.

Another example is that the demonstration was converted from a wastewater reclamation and reuse facility into a park *based* on reclamation and reuse technologies in 1989. The project engineer explained the reason was because cholera was becoming a concern in the area around 1988-1989 and COLEF did not want the presence of wastewater in Ecoparque to be associated with cholera. He added, "I thought a way to defeat that was to get the people acquainted with the notion that wastewater was a resource, not a problem." Though reusing the water for green space was always a major component of the technology, the conversion into a more socially acceptable park required adaptations for the public to access and enjoy the space such as well-maintained paths and other beautification measures.

Mutual Adaptation Revisited

In summary, the implementation of Ecoparque can be described as a process of mutual adaptation, between the technology and the organization of people who worked on the project. During this process, however, both the technology and the organization of people were also influenced by and forced to adapt to their surrounding political, economical, and cultural contexts. Figure 5 summarizes the forces of adaptation.

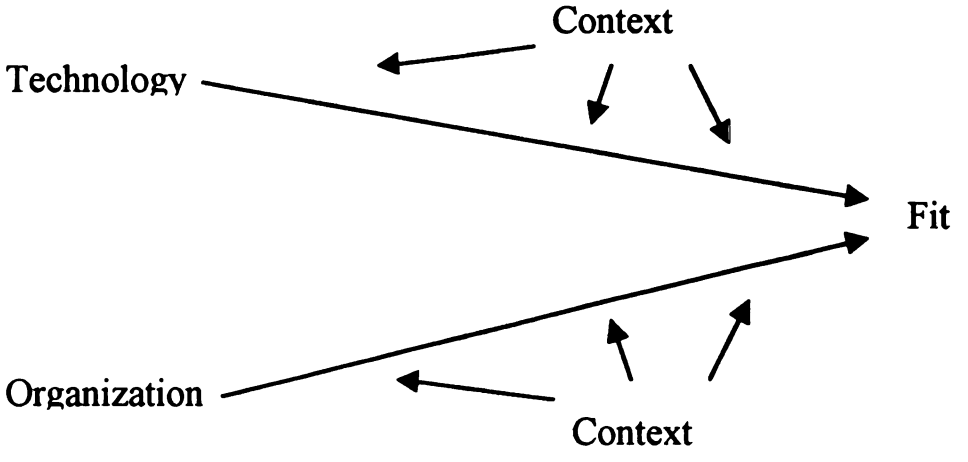

Figure 5. Forces of adaptation.

Facilitative Factors

Despite the myriad of barriers that, according to theory would have prevented a successful implantation of a demonstration project, Ecoparque has continued to function at the Tijuana site for the past nine years. It has not only continued to demonstrate a simple technology for wastewater treatment, but it has been able to meet at least some of its goals such as providing an alternative wastewater treatment process for some neighborhoods in Tijuana and increasing awareness about environmental issues in general. It has, of course, suffered many setbacks and not yet succeeded in a widespread replication of similar strategies, but what are the factors that counteracted the many barriers?

The first explanation is the people who worked on the project. They were a major factor in the implementation of Ecoparque. The passion and motivation they brought to their work helped the project hurdle each of the barriers mentioned above. Even when it seemed like the project would crumble, such as after the IBWC refused to renew the lease on the first site in the United States or when construction halted in Mexico because all funds had been exhausted, these people managed to find a way to finish what they had started.

The second explanation is that these same people were able make the necessary political connections to move the project beyond the barriers they faced during its implementation. As someone who worked on the project with the Coastal Conservancy said, "I think the success of this project can be attributed less to the technology, than the fact that we all did a lot of political leg work." These connections paid off very early, beginning when SWIA recommended the technology to the Coastal Conservancy. The

Coastal Conservancy may have never agreed to fund the first phase of the demonstration had SWIA not already built a good working relationship with them while creating the Tijuana River National Estuarine Reserve. Making political connections also benefited the project later, after the project had been shut down by the IBWC. If the project engineer had not already established a relationship with the president of COLEF, the project might never have moved to Mexico, or even found a second site.

Making each political connection work, however, required taking the right approach. The same representative from the Coastal Conservancy suggested that the key to using a connection was not to focus on a contact's objections about the project, but rather to emphasize how that person would benefit from the project. She said that this approach, for example, helped convince a couple key members of very conservative California States Coastal Commission[4] board to vote in favor of funding a second phase for the demonstration project.

The most encompassing facilitative factor for the implementation of the project was the adaptive approach, as described above. The flexible, adaptive approach may not have been deliberately planned. Because the technology was new and its implementation was somewhat uncertain, step-by-step long-term plans probably could not have been made from the beginning. The improvisational approach was necessary and ultimately became a benefit because each time a barrier appeared, either the organization or technology changed to accommodate it.

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[4] The Coastal Commission was responsible for making decisions on whether or not to fund projects sponsored by the Coastal Conservancy.

Chapter 6

Case Study Summary, Conclusions, and Recommendations

Introduction

This chapter presents the summary and conclusions of the case study. This chapter ends with recommendations for further study for Ecoparque and for diffusion of innovations, specifically dealing with the implementation of demonstration projects.

Summary

People have been conducting demonstration projects for years in attempt to speed the rate at which innovations diffuse. As a result, people have also been conducting research on demonstrations to see what factors typically lead to their success or failure. One of the factors that has been largely passed over in past research is the stage of implementation, the process where a demonstration is actually conducted. This study has, therefore, attempted to add to the existing literature and provide further insight into this important process through examination of a wastewater reclamation and reuse project on the U.S.-Mexico border called Ecoparque.

This study draws on concepts from four literature bases, including diffusion of innovations, demonstration projects, innovation implementation, and wastewater reclamation and reuse. These concepts provide insight into the reasons why demonstrations are conducted, the appropriate time or situation that they should be employed, and the key factors involved in their planning and implementation. They also introduce ways to approach the process of implementation as a step by step progression

of pre-planned strategies or as a process of mutual adaptation between an innovation and its environment.

Ecoparque, located in Tijuana, Mexico, has been operating since 1991, demonstrating how wastewater can be reclaimed and reused at a small scale and a low cost to create urban green space. While Ecoparque's Tijuana operation began in 1991, the project had its start in 1983 in the United States. It was originally designed to help prevent wastewater, flowing through the Tijuana River from Tijuana to the United States, from threatening the Tijuana River National Estuarine Research Reserve and other sensitive coastal waters. The first phase of the demonstration project, funded by the California State Coastal Conservancy, was implemented and conducted in the United States just south of San Diego for approximately nine months. The second phase of the demonstration, also funded by the California State Coastal Conservancy, began at the same site in the United States. The project, however, was ultimately implemented in Tijuana five years later.

Problems with lease on the site where the project had been operating during the implementation of the second phase of the project forced the project to shut down and move to another site. The second phase construction that had begun in the U.S. had to be re-started at a new site in Tijuana. The problems continued when funds for the second phase of the demonstration were exhausted. The project was forced to shut down for another three years before people working on the project would secure additional funds, complete construction, and begin to test the technology. Ecoparque was ultimately implemented, at its present location in Tijuana in 1991.

This study draws from two sources of data: open-ended, semi-structured interviews and archival research. Through qualitative analysis, data from the interviews and archival research were interpreted, reduced, and categorized to construct a narrative of the implementation of Ecoparque. The validity of the results from the data analysis was verified through triangulation and member checking.

People who worked on Ecoparque encountered a number of barriers to implementation. These barriers were both political and economic in nature and were founded in a general resistance to change. People who worked on the project, however, were able to overcome each of these barriers and ultimately implemented both phases of the demonstration project. Their ability to move past each barrier was not based on strategies outlined in the literature, but instead due to the passion and motivation they brought to the project, the use of political connections in the project's favor, and the flexibility with which the project was managed.

Conclusions

The overall conclusion of this study is that the process of implementation for a demonstration project can be highly unpredictable. This is particularly apparent when projects like Ecoparque, which are based on a simple, low-cost design, encounter unforeseen problems and require many years to be implemented.

Process of Implementation

A number of literature sources (e.g. Mills and Asano 1998, Baer et al. 1976) have suggested basing the process of implementation on a list of strategies. After studying the

case of Ecoparque, however, it appears that implementation may occur even when none of these strategies are followed. This study draws from the model of mutual adaptation (Leonard-Barton 1988a, 1988b) to help describe Ecoparque's implementation. Instead of being a step by step realization of a implementation plan, the process of implementation for Ecoparque was dynamic, with the innovation and organization adapting to each other over time.

This study, however, does not follow exactly the conceptual framework developed by Leonard-Barton (1988a, 1988b). She does not discuss how the process of adaptation is affected by influences outside of the organizational environment in which the innovation is implemented. An analysis of the implementation of Ecoparque has revealed that the broader context (e.g. political, economic, cultural factors) in which the innovation is being implemented does affect the process of adaptation. The external barriers encountered by the organization of people who worked on Ecoparque, for example, played a major role in the evolution of both the innovation and the organization.

The process of implementation should, therefore, be broadened from Leonard-Barton's (1988a, 1988b) concept of two elements adapting to one another to include other elements, namely the various contextual factors surrounding an innovation and the organization. As in the case of Ecoparque the innovation and the organization did adapt to one another, but both adapted under the influence of an additional element: their surrounding context.

This process of adaptation had beneficial consequences. In Leonard-Barton's (1988a, 1988b) analysis of mutual adaptation, the end result of the process of mutual adaptation is that the technology is better aligned with the organization. With

Ecoparque, where the technology, organization, and context interacted in the implementation process, the end result was a better fit of the three forces of adaptation. The organization learned how to use a technology to solve a given problem, the technology was adapted to fit the interests and abilities of the organization, and both the organization and technology changed over time to adapt to the economic, social, and political forces in the context. Today, there is a technology in place that is run by an organization, both of which operate within the contextual systems of Tijuana.

Demonstration project managers should be aware, however, that the process of adaptation can be rather lengthy and that this may have some drawbacks. One of these drawbacks was highlighted by a project consultant when he implied that the combination of technologies at the heart of Ecoparque, considered to be innovative when the project first started, had become mainstream and standardized by the time operations began in Tijuana.

The Ecoparque Demonstration

Ecoparque was first developed during the eighties by a group of concerned citizens from San Diego. The project was meant to be a solution for some of the wastewater problems plaguing the Tijuana River. While tested in the United States, the goal was to have the technology at the core of Ecoparque adopted and diffused throughout Tijuana. The technology would help treat wastewater in areas where the existing treatment system was failing and, at the same time, create a new source of water that could be used for something beneficial such as the development of community green space.

The organization of people who worked on Ecoparque have, to a certain degree, accomplished their goal. Ecoparque has been operating in Tijuana since 1991, reclaiming wastewater and using it to create one of the few visible green spaces in the city. Exceeding initial expectations, of reclaiming and reusing water, Ecoparque has also become a park where people can come learn about environmental issues that are important in Tijuana and all along the border.

The same organization of people, however, is finding that implementation success does not always translate into a successful demonstration that speeds diffusion. While operating at its present site in Tijuana, Ecoparque has failed to diffuse through Tijuana or anywhere else along the border. Organizations in other cities in Mexico have inquired about the technology and sought advice for starting their own versions of the project, but none have come close to implementing their own Ecoparque.

One explanation for Ecoparque's failure to speed the rate of diffusion throughout Tijuana could be that the people who implemented the project did not initially clarify whether the demonstration would be experimental or exemplary. In fact, it could actually be argued that Ecoparque shared characteristics of both experimental and exemplary demonstrations. The first phase of the demonstration, conducted in the United States, was experimental in nature. The focus of the demonstration was to test and further develop the reclamation and reuse system and, for that reason, visibility was kept to a minimum. The second phase of the demonstration, conducted in Mexico, was meant to be exemplary. The organization of people behind Ecoparque wanted to implement the project and share the fruits of their labor. As the second phase became operational, however, there were still plenty of experiments to do. The design was completely

different from the first demonstration and included at least two new components: the clarifier and the compost unit. They also had areas on-site excavated for future wetlands and ponds, but not in use, which led some interviewees to call the project, eight years after its implementation, a work in progress. As Dearing (1997) suggests, demonstration projects should take on characteristics of either experimental or exemplary demonstrations, not both. Allowing potential adopters to see an innovation while it is still being tested, permits potential adopters to walk away from the project perhaps more uncertain about the innovation than when they had arrived.

Ecoparque as a Development Project

As introduced in the first chapter, development can be simply defined as positive change, usually seeking to change a problem. Often development is carried out through the implementation of an innovation. Successful implementation, however, does not always equate to development success.

The organization of people responsible for Ecoparque's implementation developed a technology that would help protect the Tijuana River National Estuarine Research Reserve and other sensitive coastal waters between Tijuana and San Diego. The organization tested the technology in the United States and then decided to move the second stage of the demonstration project into Tijuana, the source of the wastewater problems. The project was designed to benefit both sides of the border. The project, however, like most other development project of its era, followed a technology transfer model that worked under the assumption that technology developed in one place would be appropriate in other places (Chambers 1997). The organization of people working on

Ecoparque, which included some Mexicans from Tijuana, decided to implement the project in a location where people, at the time, were not asking for or even considering the type of technology Ecoparque had to offer.

The approach taken to implement Ecoparque can be critiqued, especially given today's development theories such as bottom-up development (Chambers 1997), participatory action research (Fals-Borda and Rahman 1991), and autonomous development (Esteva 1997), which emphasize development arising from the ideas, needs, and abilities of the people benefiting from the development. A critique, though, is not the intent of this author because at the time Ecoparque was implemented, technology transfer was an accepted mode of development. What development theories offer, however, are different perspectives through which to analyze Ecoparque's implementation as a development strategy, each bringing out different issues to consider.

For instance, critics of technology transfer (e.g. Ullrich 1997) raise questions about the assumptions behind using technology as the solution to problems. An assumption is that a technology developed under a particular context and in response to particular needs is appropriate in another context with potentially different needs. Ecoparque was developed in the United States by Americans who perceived a water pollution problem. A critique of technology transfer may pose questions such as, "Do people in Tijuana perceive the problem in the same manner or view Ecoparque as the best means to solve the problem?" If these questions were answered before Ecoparque was moved to Tijuana, the implementation of this demonstration may have taken a different direction.

Participatory approaches to development (Chambers 1997, Esteva 1997, Fals-Borda and Rahman 1991) raise the question, "Development for whom?" Participatory approaches emphasize the need for posing the development problems, defining the course of action to solve the problems, and taking those actions all to be done by the people most affected by the problem. Therefore, one may ask who were "the people" in the case of Ecoparque. In one sense, it was community people in San Diego who defined the problem of wastewater contamination of fragile estuary ecosystems. These same people developed and implemented a solution to this problem. This can be seen as very participatory. However, when Ecoparque was moved to Tijuana, the source of the problem, one may frame the case as one of an outside group defining a problem and imposing a solution on a local community. Some people did seek to include local input before Ecoparque was built in Tijuana, but the input was limited primarily to COLEF staff members. Therefore, when the implementation of Ecoparque, both in its first stage in the U.S. and its second stage in Mexico, is analyzed from a participatory development approach, issues of who defines the problem and formulate the solution arise. If Ecoparque was implemented in Tijuana with more community involvement, again, the outcome today may have looked very different.

Recommendations for Future Research

While the lessons learned in this case study may be valuable for future research or for future demonstrations, they must also be evaluated with the understanding that they come from a single case study. Ecoparque was implemented in a unique context. The experiences of Ecoparque's implementation will be distinct from the experiences other

demonstration projects have as they are implemented. The generalizations generated in this study must, therefore, be tested in future studies on other demonstration projects.

This case study was an example of how complicated the implementation of a demonstration can be. Understanding how barriers and facilitative factors affect and change the implementation process is useful for guiding future demonstration projects. Future studies on the implementation of demonstrations can build on the lessons learned in this study by either testing to see if other demonstrations are affected by the same factors or exploring to see how other factors, not identified in this study, affect other demonstrations.

Diffusion of Innovations

Although this study has focused on the implementation process of Ecoparque, it could have just as easily focused on the diffusion of Ecoparque. Future studies on Ecoparque could explore the reasons why the technology has yet to be diffused into wide spread use. To date, four or five projects in Mexico have attempted to implement their own Ecoparques. A former director of Ecoparque commented that other organizations in Mexico had attempted to adopt Ecoparque and implement their own version since the demonstration began operations in Tijuana. A future study could investigate how these projects have faired and if any of their implementation experiences compared to the implementation of Ecoparque.

Mutual Adaptation

This study showed how the context in which a demonstration is implemented could have an effect the on process of adaptation that takes place during implementation. Future studies could take this analysis one step further and examine whether or not elements of the context may also adapt to the organization and/or technology. Though this was beyond the scope of this study, the fact that Ecoparque was eventually acknowledged by Tijuana city officials as a small part of Tijuana's overall wastewater treatment plan suggests the technology and organization did cause at least one change in the city's wastewater context.

Development

When the diffusion of innovations is for the purpose of positive change, or development, framing each case in various development theories raise different issues. Whether examining similar cases to Ecoparque or broadening our understanding of mutual adaptation to include the context, considering them from different angles can help inform the development of demonstration projects and how they are implemented, thus insuring the best possible fit of the innovation, the organization, and the context.

APPENDICES

Appendix I

Consent Form

You are being asked to participate in research for a master's degree thesis. The purpose of this study is to gain a better understanding of the factors involved in the implementation of a demonstration project, specifically Ecoparque in Tijuana, Mexico. During the interview, which will last approximately one hour, you will be asked questions about your professional and/or personal views on Ecoparque. Your identity will remain confidential and though your name will not appear in any published document or presentation, you may be identified by your professional position and/or an alias. Your participation is entirely optional. You may refuse to participate in this research and may choose to discontinue the process at any time without any negative consequences to you.

With your permission, this interview will be taped. After the recording has been interpreted, it will be erased. By writing your initials below next to the consent to record, you are indicating your agreement to have this interview recorded. If you choose not to be recorded but agree to have the interview, sign this consent form and do not write your initials.

By signing below, you are stating that you fully understand: the purpose of the research, your involvement in it, and your willingness to participate. If you have any further questions, please feel free to contact the researcher, James Harding, or Dr. David Wright of Michigan State University at:

James Harding	Dr. David Wright
122 S. Foster	Chairperson of the University Committee on Research
Lansing, MI 48912	Involving Human Subjects (UCHRIS)
U.S.A.	Michigan State University
(517) 485-1258	(517) 355-2180

I agree to have this interview recorded. _____

Signature _____

Name _____

Date _____

Appendix II

Sample Interview Protocol

Respondent Occupation:

Interview Location:

Date:

Time:

Interview Procedure:

1. Explain the purpose of the interview.
2. Read the participant consent form to the interviewee.
3. Ask the interviewee to sign the consent form to indicate that he/she understands the purpose of the research, his/her involvement, and his/her willingness to participate.
4. Ask interviewee if he/she would mind being tape-recorded.
5. Ask if the interviewee has any questions before the interview formally begins.
6. Thank the interviewee at the end and provide contact information.

Questions:

Interviewee's professional role in relation to Ecoparque

1. What was/is your involvement in the Ecoparque project?

2. How has that involvement changed over time?

Main goals of Ecoparque

3. What is the purpose or goal of Ecoparque?

4. Is that purpose or goal different from what it was when the project was first conceptualized? If so, how has it changed? (Experimental versus Exemplary demonstration)

Stakeholders involved in the implementation process

5. Who has been responsible for Ecoparque's development? Has that changed?

6. How did these individuals/organizations become involved with Ecoparque?

7. Who were the principal project promoters? (Prompt: Who were the project champions?)

Reasons for Demonstrating the Technology

8. Who was the project designed for? Who was meant to use an Ecoparque-type technology?

9. How was Ecoparque designed to reach these potential users?

Demonstration site-selection

10. When was Ecoparque first operated at its present location? Why was this site chosen?

11. Why was the decision made to build the project in Tijuana? Who made this decision?

Positive and negative reactions to Ecoparque and the effects of these reactions

12. What were the reactions to the plan to build Ecoparque? Who reacted that way and why? (Prompt: Was there any opposition or support to the project before it was implemented? If so, who opposed/supported it?)

IF answer to 12. was "there was opposition," ask questions 13-15:

13. What steps were taken to work through the opposition? Why? (Prompt: were adaptations made to the innovation, the environment, or both?)

14. Were there any other barriers to implementation? (Prompt: were there political/ technical/economic/cultural barriers to implementation?)

15. How could things have been handled differently to avoid these problems before or during the implementation process?

IF answer to 12. was "there was support," ask questions 16 and 17:

16. How was this support helpful in getting Ecoparque built and running?

17. How could things have been handled differently to make the implementation process smoother?

Appendix III

Timeline of Major Events

Year	Event
1983	A group of concerned citizens in San Diego, California begin discussing methods for addressing the chronic water quality problems of the Tijuana River.
	The group of citizens meets two PhDs who have developed a simple technology for treating wastewater.
	A meeting is held in San Diego to discuss alternatives for resolving problems with water quality in the Tijuana River.
	The California State Coastal Conservancy asks the Southwest Wetlands Interpretive Association (SWIA) to explore solutions for treating Tijuana's wastewater.
1984	SWIA sends a report to the Coastal Conservancy proposing it test the core technology; a stainless steel screen, plastic biological filter, and settling tanks.
	The Coastal Conservancy decides to fund a demonstration project where the technology may be tested
	SWIA finds a site for demonstration in the United States on property leased by the International Boundary and Water Commission (IBWC).
	SWIA hires a group of consultants from the United States and Mexico to run the demonstration.
1985	Construction begins at the new site.
	Construction is finished at the new site.
	Each component is tested using Tijuana wastewater tapped from the emergency connection.
	Wastewater from the emergency connections begins running through the system 24 hours a day 7 days a week.
	The demonstration is dedicated.
1986	After running the demonstration for nine months, SWIA decides the project should be expanded.
	SWIA asks the Environmental Defense Fund (EDF) to act as project manager.
	The EDF accepts managerial control and submits a new proposal for a second phase of the project to the Coastal Conservancy.
	The Coastal Conservancy agrees to fund a second phase of the demonstration.
	The IBWC shuts off the emergency connection between Tijuana and San Diego.

Year	Event
1986, continued	The project manager decides to proceed with the second phase
	The EDF hires a contractor to help expand the demonstration to include a clarifier, a composting unit, and a system of wetlands and ponds.
	Construction for the second phase begins.
	The IBWC notifies the EDF that it will not renew its lease.
	The IBWC asks the EDF to stop construction and remove everything from the site.
	The EDF removes all equipment and materials from the site and puts them in storage.
	The EDF searches for a new site.
	The project engineer finds a new site for the demonstration in Tijuana.
	El Colegio de la Frontera Norte (COLEF) becomes the EDF's partner on the Mexican side of the border.
	La Promotora de Desarollo Urbano de Tijuana, S.A. (PRODUTSA) agrees to loan the site in Tijuana to el Colegio de la Frontera Norte (COLEF) for five years.
1987	The Attorney General of California authorizes the Coastal Conservancy to spend state money on the demonstration even though the project is located outside of state boundaries.
	The Institute for Regional Studies of the Californias at San Diego State University (SDSU) accepts the equipment and materials from the first facility as a donation and transports them across the border duty free.
	The EDF and COLEF clear the new site and begin construction.
1988	Project funds are exhausted.
	The EDF stops construction at the new site.
1990	The EDF obtains funding from the Coastal Conservancy and the General Service Foundation.
	The project engineer secures additional funding from *La Secretaría de Desarollo Urbano y Ecología* (SEDUE), *Fundación la Puerta*, and the Mexican Council of Science and Technology.
1991	The EDF and COLEF finish construction at the new site.
	The EDF and COLEF tap into a sewer from a neighboring community, *la Colonia Otay Universidad*, and test the new facility.
	The EDF and COLEF authorize the demonstration to run 24 hours a day, 7 days a week.

Appendix IV

Treatment Components

Figure 6. Fine Screen (Hydrasieve)*.

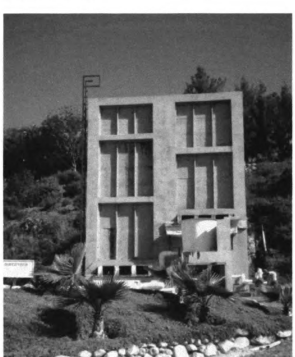

Figure 7. Biofilter.

* Photographs were taken by the author.

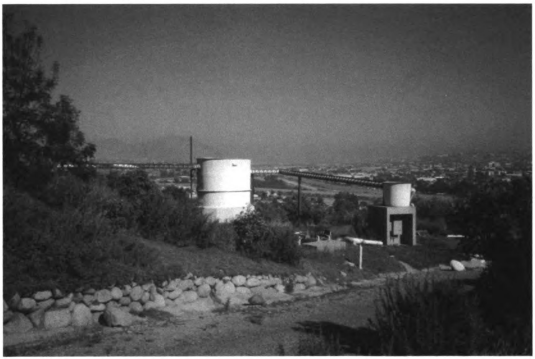

Figure 8. Clarifier.

Figure 9. Compost Unit.

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