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**A Holistic Approach to the Assessment of Sanitation  
Development in Mexican Villages**

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## Abstract

Lack of, or inadequate sanitation development is a serious issue worldwide, especially in developing countries, where it severely affects human health, the environment and the economy. Despite the 'Water Decade' (1980-1990) and the repeated commitment of the international community to address sanitation development as a priority, the proportion of people enjoying good sanitary conditions in developing countries has not improved during the 1990s. During the last 30 years, post-colonial engineering-oriented approaches to sanitation development were gradually supplanted by multidisciplinary strategies. However, the specialists (e.g. engineers, epidemiologists, economists, sociologists, anthropologists, etc.) involved in development programs tend to view sanitation development from the narrow perspective of their respective discipline. As a consequence, sanitation development is perceived in a fragmented way.

This research assumes that this fragmented perception is a major cause of the current state of sanitation worldwide and proposes to improve the understanding of sanitation development by viewing it as a whole. A methodology principally based on qualitative methods of investigation was set up to assess sanitation development in a holistic way. This approach was then tested on three communities in Central and South Mexico. For each case study, the main factors influencing sanitation development and their relationships were identified and organised graphically on paper in the form of conceptual maps.

The holistic approach to the assessment of sanitation development is comprehensive and transparent. Despite some weaknesses, the conceptual maps successfully highlight the diversity and the interconnectedness of the factors influencing sanitation development. This research identifies major political, cultural, or economic factors hindering sanitation development throughout Mexico and explains how they interact as a system. As a consequence, this study constitutes an original and valuable attempt to counterbalance the habit of breaking up sanitation development into distinct and separate disciplines. It calls for more interaction in development programs, converting multidisciplinary teams into interdisciplinary teams.

Although this study efficiently tackles the fragmented perception issue, a deeper insight into sanitation development can be gained by addressing it in more detail from critical macro-economic and macro-political perspectives. Testing of the holistic approach to the assessment of sanitation development in the context of real life projects is required to validate its usefulness as a decision-making aid.

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# List of symbols and abbreviations

## Symbols

|                                              |                                        |
|----------------------------------------------|----------------------------------------|
| EC: Electrical conductivity                  | NO <sub>3</sub> <sup>-</sup> : Nitrate |
| COD: Chemical oxygen demand                  | NH <sub>3</sub> : Ammonia              |
| BOD <sub>5</sub> : Biochemical oxygen demand | FC: Faecal coliform                    |
| \$: Mexican pesos                            | MPN: Most probable number              |

## Abbreviations

|                                                                               |
|-------------------------------------------------------------------------------|
| CEAPA: Water Supply and Sewerage Commission of Aguascalientes state           |
| CIIDIR: Interdisciplinary Research Centre for Integrated Regional Development |
| CNA: National Water Commission                                                |
| COPLADE: Planning Committee for State Development                             |
| DIF: Office for the Integrated Development of the Family                      |
| IEEPO: Institute of Public Education of Oaxaca state                          |
| NGO: Non Governmental Organisation                                            |
| PAN: National Action Party                                                    |
| PRD: Democratic Revolutionary Party                                           |
| PRI: Revolutionary Institutional Party                                        |
| SEDESOL: Secretariat of Social Development                                    |
| SEMARNAP: Secretariat of Environment, Natural Resources and Fishing           |

## Glossary

### **Ejido, Ejidatarios, Ejidal Commissioner:**

An *ejido* is an area of land communally owned by a group of *ejidatarios* with a specific system of democratic social organisation. They were first introduced in 1917 through post-revolutionary reforms designed to repossess privately-held estates and return the land to peasant farmers in a bid to redress the imbalance in wealth distribution. Redistribution was first implemented in seriousness in 1934 by Lázaro Cárdenas. Originally *ejidos* could not be sold, rented or used as collateral and only the resident registered *ejidatarios* could work on them. *Ejidos* are represented by a committee which is voted in on a rotational basis every three years, called The Authorities. They provide an unpaid service to the community and may have to invest considerable time and effort. The Authorities are divided into three subcommittees with different functions:

- The Consejo del Comisariado: Includes a president (El Comisariado, the *ejidal commissioner*), a secretary, a treasurer and a deputy. They are responsible for anything the community needs to have done and the organisation of all communal affairs. The president calls and leads General Assemblies.
- The Consejo de Vigilancia
- La Municipal

(Konstant 1997)

### **Mixtec**

Ethnic group present in the state of Oaxaca

### **Municipality, Municipal President**

Municipalities are the basic administrative units of state governments as provided in the Constitution. The municipal president and municipal council are elected by direct vote for a three-year period and they are not eligible for immediate re-election. The municipal council is composed of the municipal president; a 'public trustee', and councillors (OECD 1997).

**Municipal Agency, Police Agency, Municipal Agent**

Internally, the municipality is divided in agencies (municipal agency or police agency directed by the municipal agent), which take part in the public administration. Similarly, almost all the communities or residential zones located on the municipal area have got their council for the management of the most urgent requirements and their members are valid interlocutors in front of the municipal authorities (Velasco Rodriguez and Aguilar Sanchez 1999).

**Sewer Committee, Electricity Committee, Water supply Committee**

The population of small communities usually elects committees that are in charge of specific issues and that, in principle, work together with the community councils.

**Tequio**

In the pre-colonial period, the civilisations Mixtec and Zapotec established strong social institutions of solidarity and mutual help. The main ones, the *guelaguetza* and the *tequio* still remain and represent important aspects of the social life in the community. The *tequio* imposes to everyone the obligation of contributing to a work of common interest. This can be, for instance, the building of a school, of a temple, of the town all, of roads and bridges, marketplaces (Velasco Rodriguez and Aguilar Sanchez 1999).

# Chapter 1 - Introduction

## ***1. Sanitation development and poverty reduction***

For more than 40 years, improving water supply has been a top priority in the development programmes set up by the international community. Providing food and water for all was regarded as the chief condition to improve a population's health and thus alleviate poverty. The efforts to increase food security and water availability in developing countries certainly had positive impacts on population health, but fieldworkers and scientists have increasingly highlighted the need to pay comparable attention to hygiene promotion and sanitation development (Esrey 1996; Perez 1999).

Sanitation means the safe management of human excreta (WELL 1998). It includes the different means of collection, transport, treatment, disposal or reuse of human excreta (UNECE 1992). It is estimated that about three billion people make do without proper hygiene and sanitation, which largely contributes to the spread of a range of diseases (e.g. shistosomiasis, typhoid, and intestinal helminthic infections) and to the death of over two million infants and children annually through diarrhoeal diseases. During the last 20 years, *international, governmental and non-governmental organisations* have increasingly incorporated sanitation into their development strategies. Many humanitarian organisations specialised in medical or food aid, such as MSF (Médecins Sans Frontières ) and ACF (Action Against Hunger), now promote sanitation development as a part of their action (Action Contre la Faim 2002; Médecins Sans Frontières 2002).

## ***2. The Water Decade and the development of 'appropriate technologies'***

During the 1980s, known as the Water Decade, much emphasis was put on developing appropriate technologies, that is, technologies which fit the local conditions in terms of cost, performance, and robustness, and which are easy to operate and maintain. This period was one of very productive scientific research, which notably resulted in the construction of more robust and efficient hand-pumps, new versions of pit latrines and composting toilets, and new designs of oxidation ponds for wastewater treatment. The

composting toilets, and new designs of oxidation ponds for wastewater treatment. The rediscovery of natural wetlands as efficient sewage treatment systems led to the engineering of constructed wetlands. Pilot studies of this secondary wastewater treatment alternative worldwide suggested that this technology was simple, efficient, robust and easy to operate and maintain.

The original aim of my research was to assess the sustainability of a constructed wetland in El Copal, a rural community in Guanajuato state, Central Mexico. This sanitation project had been launched by the Institute of Agricultural Sciences of the Guanajuato University with the support of Texas A&M University. As far as I knew, the domestic sewage underwent a primary treatment in an Imhoff tank and a secondary treatment through the constructed wetland. Before my arrival to Mexico in June 1999, I started to realise that there could be a gap between reality and my expectations. And indeed, I was informed, quickly after my landing at Guanajuato airport, that the constructed wetland was still in construction. I quickly reviewed the situation during the next days and I concluded with much frustration that the wastewater treatment system was not going to be operational soon.

Investigating in detail the reasons for the very slow progress of the constructed wetland project turned out to be a crucial step in the development of my research. As I reviewed the literature about sanitation in Mexico, I found out that the situation in El Copal was not an exception. Many sanitation projects involving ‘appropriate technologies’ failed, and the examples of sustainable sanitation projects were actually scarce. Given the situation in El Copal, the initial plan for my study was not feasible, and the overall orientation of my research then appeared irrelevant to me. What was the point of determining whether the pathogen removal rate of the constructed wetland was 96%, 99%, or 99.9% if in most cases the wastewater treatment plants were not well maintained or were abandoned after a few years?

### ***3. Redirecting the study aim***

To understand why sanitary conditions did not improve significantly in most communities seemed far more relevant to the common problems met in Mexico. As I interviewed the stakeholders of the constructed wetland project in El Copal I got the

technology. In addition to the technical aspects, a large number of economic, political, social and cultural factors affect sanitation development. Simultaneously, it became clear to me that people in general and notably in Mexico, do not consider the sanitation issue globally. Instead, they tend to perceive and tackle the problem in a fragmented way: some civil engineers build the water supply infrastructures while others deal with the sanitation services. Medical staff struggle to control water-related infections and promote better hygiene. As for politicians, they want quick and tangible results and think in terms of sanitation coverage, that is, the percentage of the population with access to latrines or sewer systems. They often fail to realise, though, that proper use of these latrines is crucial and that sewer systems are not a satisfactory solution without sewage treatment.

The reports of UN bodies, governmental and non-governmental organisations also tend to describe sanitation development in a fragmented way. Although these reports put much emphasis on the complexity of the issue, the factors influencing sanitation development are arranged by disciplines and presented as if they could be understood independently. The structure of these reports (Bendahmane 1992; WELL 1998; WHO and UNICEF 2000) is sometimes very revealing of this fragmented perception (e.g. chapter 1: technical aspects, chapter 2: economics, chapter 3: sociocultural aspects, chapter 4: institutional aspects, etc.). Breaking up a complex issue and analysing in detail its components is the common practise in the West. It is certainly very practical but it fails to consider the interactions between all the factors. It also encourages the specialists (e.g. engineers, sociologists, and economists) to remain confined in their fields of expertise instead of increasing their awareness on the interaction of their disciplines.

#### ***4. Sanitation development as a system***

At this stage of my investigation in Mexico, I formulated the working hypothesis that the fragmented perception of sanitation development could be a major cause for the failure of the international community to improve the sanitary conditions of a larger percentage of the world population. Changing the perception of sanitation development by removing the artificial boundaries between the different aspects of the issue could help the stakeholders launch more integrated strategies reflecting better the reality.

Thus, it was decided to study and represent sanitation development as a system, whose components are the various factors (e.g. economical, technical, political, sociocultural, etc.) encouraging or hindering the improvement of sanitary conditions. A methodology was designed and pilot-tested in El Copal, that allowed to tackle the complexity of the system, focusing on the interaction of its components. This methodology was then applied to three communities of Central and South Mexico. After 20 months of fieldwork, the data collected were analysed and a graphical representation of sanitation development in each of the three communities was produced.

The originality of this research stems from the unprecedented attempt to counterbalance the habit of viewing sanitation development in a fragmented way. As a by-product, this study provides a rich description of the impediments to better sanitary conditions in Mexico, but the primary contribution of this work resides in the development and the evaluation of a holistic approach to the assessment of sanitation development. The conceptual maps can be regarded as the end product of the research. They crystallise the purpose of this research by demonstrating the possibility to view sanitation development as a whole.

## ***5. Structure of the thesis***

The author recognises that this thesis is unusually lengthy. This is partly due to the graphical means chosen to represent sanitation development. Nonetheless, the reader will be provided with some advice, which will make the reading of this thesis as convenient as possible.

Chapter 2 presents in detail the context of the research. It first outlines the state of sanitation in the world today and gives an overview of the water supply and sanitation development programmes since the 1960s. The complex nature of sanitation development is addressed, as well as the notion of fragmented perception. An introduction to holistic approaches from a philosophical perspective leads to the statement of the aim and objectives of this study.

Chapter 3 deals with the methodological aspects of the research. It describes the holistic approach developed to assess sanitation development as a system. The first part defines the research design and the data collection techniques, which led to a comprehensive



exploration of the different factors affecting sanitation development in the three case studies. The second part of the chapter explains how the data collected were analysed, with a focus on the interactions between the system components. The final step of the holistic approach, that is the graphical presentation of the sanitation development as a system using conceptual maps, is described.

Chapter 4 presents and describes the conceptual maps. Despite all the efforts made to be as concise as possible, this chapter is about 160 pages long, accounting for almost 45% of the total thesis. The inclusion of the three case studies and the insertion of numerous quotes and pictures largely contribute to the length of this chapter. An introductory section provides the reader with some advice on how to read these results. Due to the length of this chapter, the reader is given the opportunity to ‘skip’ one or two case studies by reading their respective introductions and conclusions only. For each case study map, all the factors and their relationships are concisely defined, brought to life by pictures, quotes and other data from the community studied. This chapter allows the reader to examine a holistic representation of sanitation development. It provides the opportunity to develop a global understanding of the issue, stressing the significance of the interactions between factors.

In Chapter 5 the similarities between case studies are extracted. These common patterns are put into the context of the existing literature in order to discuss the relevance of drawing generalisations. For instance, the review of political and cultural studies confirms that some patterns common to several case studies, such as lack of political continuity, machismo and corruption, can be considered as impediments to sanitation development throughout Mexico. As such, Chapter 5 is a valuable contribution to the understanding of sanitation development in Mexico.

Chapter 6 puts aside the context-specific aspects of the findings and focuses on the form of the results, that is to say, their graphical representation. The strengths and weaknesses of the conceptual maps as well as their validity and usefulness are discussed.

Chapter 7 stands back from the results and examines critically the holistic approach developed in this research. The limitations of the methodology are discussed from a philosophical perspective. The limitations of holism, the influence of the observer bias on the results, and more generally the objectivity of the approach are addressed. The transferability of the methodology is discussed.

The first part of Chapter 8 determines the different domains of application of the study. The holistic approach to the assessment of sanitation development is presented as a versatile tool with potential uses beyond the boundaries of the water and sanitation sector. The second part makes suggestions for further research in the same line of investigation.

Chapter 9 concludes this research, summarising the results and recapitulating the different points elaborated in the discussion chapters. It offers the reader an opportunity to realise to which extent the work undertaken has achieved its initial objectives.

## **Chapter 2 - Understanding Sanitation Development**

### ***1. Sanitation in the world today***

#### **1.1. In western societies**

##### **a) The situation today**

Most sanitation systems in the western societies are now based on the centralised sanitation system, by which the excreta is collected in cistern toilets, channelled away through the sewer network, and treated in wastewater processing plants. After a series of physical, chemical and bacteriological processes the effluent is eventually discharged to surface waters. These centralised systems are prevalent in high-density zones, whereas on-site sanitation systems, such as septic tanks, remain in operation in rural zones. A very wide range of wastewater treatment plants have been built, from simple and robust technologies, such as oxidation ponds and constructed wetlands, to highly sophisticated and expensive high-rate plants.

At the turn of the 21<sup>st</sup> century, 92 and 100 percent respectively of the European and North American populations have access to improved sanitation, i.e. a connection to a public sewer, a septic system, or the use of pour flush, simple pit or ventilated improved latrines (WHO and UNICEF 2000). Thus, western societies have almost achieved one of their chief objectives: to provide access to sanitation facilities for everyone. Furthermore, 66 and 90 percent respectively of wastewaters are treated in Europe (including Russia and former Soviet Republics) and North America by effective treatment plants (WHO and UNICEF 2000).

##### **b) Disharmonies**

Hygienic sanitation facilities are available for almost everyone nowadays. The benefits that 150 years of sanitation development have brought to western societies have been significant in terms of health and convenience. Cholera and other plagues associated with wastewater and domestic wastes are now relics of the past.

Nevertheless, this very tangible progress in terms of population health (as measured by life expectancy, or infant mortality, for instance) was arguably achieved at the expense

of the environment. Some disharmonies stem from the centralised approach to sanitation, whereby nutrients, microbiological contaminants, and hazardous chemical substances reach high concentrations at the end of the sewer pipe. The environment is being degraded, directly affecting human health and activities. Indeed, as Esrey (1999) points out: ‘Western sanitation solutions were designed and built on the premise that human excreta is a waste suitable only for disposal and that the environment is capable of assimilating the waste. The panacea of the 19<sup>th</sup> century is turning out to be the Pandora’s box of the 21<sup>st</sup> century. [...] Conventional sanitation systems have focused on how to treat pathogens and/or keep human excreta away from people. In the process we have used and contaminated large quantities of fresh water, and destroyed land and marine ecosystems’ (Esrey and Andersson 1999).

Despite continuous technological innovation, conventional sanitation systems remain only relatively efficient and their side effects are numerous. Faecal pathogens, dangerous chemicals, pharmaceuticals and carcinogenic substances, such as chlorine disinfection by-products, are still found in the treated effluents. Conventional sanitation also raises the issue of soil fertility: a large proportion of the nutrients flowing into oceans is the result of raw or partially treated sewage. Centralised sanitation systems have resulted in a lower proportion of the nutrients contained in human excreta and animal manure returned to the land, and an increasing dependence on inorganic chemical fertilisers. The sustainability of this system is questionable as well as its short and long term impacts on health. Reducing the impact of the sanitation systems on the environment is the current challenge faced by western societies.

Some on-site or small-scale ‘natural’ sanitation systems (e.g. composting toilets, roughing filters, constructed wetlands...) have been developed to provide cheaper, less sophisticated, more robust, and more sustainable alternatives to conventional systems. Despite some encouraging results in experimental sites and communities, the large-scale implementation of these ‘environment friendly’ systems in densely populated, urban environments seems very unlikely so far. According to the current trends, further developments will mainly build on the existing centralised conventional sanitation systems. Enhancement of wastewater treatment will be driven by the need to comply with increasingly stringent regulations concerning the quality of the treated effluent and the sludge.

## 1.2. In developing countries

### a) The sanitation crisis

#### • *A global problem*

While in developed countries nearly all human excreta is safely collected and at least partly treated before discharge into the environment, the situation that prevails in the developing regions of the world is very different. About three billion people in the world make do without access to proper sanitation (Schertenleib 1999). Roughly 10 to 20 percent of the population living in developing countries (mainly in urban areas) has access to sewer systems, and about 20 percent has some type of on-site sanitation facility. About 65 percent do not have appropriate sanitation facilities (WHO 1997). West Asia and Latin America (the lowest population and most urbanised regions of the Third World) have a better level of sanitation than East Asia and the Pacific, and Africa, which has the lowest access to proper sanitation facilities (29 and 35 percent respectively of sanitation coverage) (WHO 1997). The magnitude and the extent of the impact of lack of, or poor sanitation on health, environment and economy are signs that 'the world is now beginning to feel the first pangs of a more chronic and systemic water crisis' (World Water Council 2000).

#### • *The gap between rural and urban areas*

Sanitary conditions are particularly acute in the densely populated peri-urban areas and rural areas typically inhabited by a low-income population. A recent report from the World Bank (2001) estimates that over half a billion urban people and over two billion rural people lack sanitation services. In other words, two-thirds of the rural population of the developing regions of the world make do without proper sanitation facilities, that is, they defecate in the open air, in rudimentary buckets, pits, or filthy public latrines (WHO 1997). A small proportion of the total population of developing countries (10 to 20 percent) has access to flush toilets connected to a sewer system, and this occurs chiefly in the urban areas. Cities in poorer countries are typically only partially sewered (WHO 1997). Only a small volume of the domestic effluent collected through sewer systems is treated in wastewater treatment plants. Indeed, the median percentages of wastewater treated by effective treatment plants are respectively 0 percent, 35 and 14 percent in Africa, Asia and Latin America and the Caribbean (WHO and UNICEF 2000). It is estimated that less than 5 percent of all the wastewater produced in

developing countries receives any treatment (World Bank 2001a). In most cases, the raw sewer effluents are discharged into the nearest water bodies.

Lack of, or poor, sanitation in developing countries leads to environmental degradation. It also very significantly impacts on the health of the population, and consequently affects the economy.

- *Environmental Impacts*

The most severe environmental impacts of poor sanitation occur in large towns or big cities. In such densely populated areas, the impact of a lack of, or poor, sanitation on the environment is tangible: the capacity of the environment to process human excreta, while maintaining itself in balance, is exceeded. Centralised sanitation systems with inefficient wastewater treatment plants or without any treatment have worse impacts on the environment, since the sewer networks concentrate the raw effluents in point discharges. In addition to the release of hazardous chemical substances and pathogens, the high BOD (biological oxygen demand) and nutrient content of wastewater causes river eutrophication and leads to a decline in the population of most species. Groundwater contamination ensues, as river water percolates in the soil. River ecosystems can be destroyed as far as hundreds of kilometres downstream of the cities and the sustainability of groundwater supply for the populations which rely on the contaminated aquifer is at risk. Centralised sanitation systems, with the use of cistern-toilets also tend to put more pressure on the fresh water resources, threatening the sustainability of water supply schemes in large cities: 'In countries with low fresh water availability, urban sanitation development using sewer systems encourages a growth of the domestic water demand, putting enormous pressure on the existing fresh water resources' (WHO and UNICEF 2000).

- *Health Impacts*

Good sanitation reduces exposure to pathogens and improved hygiene acts as an additional secondary barrier to further reduce transmission of pathogens (Esrey 1996). Indeed, studies indicate that lack of sanitation puts people at higher risk of diarrhoeal disease than lack of safe water (Esrey 1996; Perez 1999).

‘Adequate sanitation is the foundation of development—but a decent toilet or latrine is an unknown luxury to half of the people on earth. [...] The main result can be summed up in one deadly word: diarrhoea. It kills 2.2 million children a year and consumes precious funds in health care costs’ (Khan 1997). Poor hygiene and sanitation are largely responsible for the global burden of diseases which are widespread in developing countries, such as shistosomiasis (200 million cases), typhoid fever (16-17 million cases), and intestinal helminthic infections (1500 million people infected). In addition, lack of proper sanitation is closely associated to the death of over two million infants and children annually through diarrhoeal diseases (Burgers 1999).

In urban environments, most of the wastewater channelled by the sewer systems is not treated and is discharged in rivers that act as open sewer collectors. These contaminated rivers remove the wastewater from the city centre, but the pathogens released represent a dreadful threat to the populations established on the city outskirts. River water contaminated by sewer effluents and faeces of the unsewered populations are used in agriculture, exposing the farmers, their families and the consumers of their fresh products to high bacteriological contamination risks. Some of the raw domestic effluent and faecal matter deposited on land without prior destruction of pathogens eventually enters surface and ground waters, sometimes surviving for considerable lengths of time and is responsible for endemic infectious diseases (WHO 1997).

#### • *Economic Impacts*

The detrimental impacts of poor sanitation on population health and the environment also have pernicious side effects on the economy. As people are weakened by diarrhoea or other excreta-related diseases, their capacity to work and participate efficiently in economic activities declines. It is increasingly recognised that neglect of WS&S services for the poor affects all segments of society. It ‘kicks the first step out from a country's ladder to development. History has taught that a safe means to dispose of bodily wastes is not a luxury that can wait for better economic times but a key element in creating them’ (Khan 1997). In addition to the loss of productivity they entail, the diseases related to poor sanitation consume precious funds in health care costs. Environmental degradation deters tourism, and the deterioration of strategic natural

resources, such as water, hinders industrial progress and slows economic growth (WELL 1998).

b) Sanitation in Mexico – a case study

In 2000, it was estimated that Mexico had a population of 97.5 million, with an average population growth rate of 1.6 percent per year since 1995 (INEGI 2001a). The demographic expansion and economic development experienced in Mexico since the 1970s has been concentrated in the medium sized and large cities of the country, leading to growing pressure on the environment and in particular on the water resources in many regions (Saade Hazin 1997; Tortajada and Biswas 1997).

In 1999, 73% of the total population had access to the sewer system (69% in 1973) (CNA 2000). There is no information available that describes and quantifies the alternative sanitation facilities used by the remaining 26 million people. It is thought that they range from cistern toilets with septic tanks or soak-away pits to composting toilets, simple or ventilated latrines, to nothing at all. The development of sanitation in Mexico essentially focused on the construction and extension of sewer networks in urban areas combined with wastewater treatment plants in the cities. 75.4 and 92.7 percent respectively of the population living in medium sized cities (2,500-50,000 inhabitants) and big cities (over 50,000 inhabitants) use the sewer system, while only a third of the rural population has access to this service (CNA 2000). Consequently, about 17 million people who live in rural areas use on-site sanitation facilities or practise open-air defecation.

Despite the need for the recovery of treated wastewater to face an increasing state of water scarcity in most regions of the country, the treatment capacity in Mexico is very limited and is not fully exploited. Only 10 percent of the sewer effluents are properly treated (Saade Hazin 1997). According to the National Water Commission four fifths of the total volume of urban wastewater produced in 1999 did not receive any kind of treatment prior to discharge to watercourses. The vast majority of the rural localities that are sewerred do not treat their wastewater. In 2000, 22 percent of all the municipal wastewater treatment plants built in Mexico were out of operation (CNA 2000). A large range of wastewater treatment technologies are used: the most common systems being



waste stabilisation ponds, activated sludge systems, Imhoff tanks, and anaerobic reactors (respectively 491, 212, 58, and 43 plants) (CNA 2000).

The economic development of Mexico has been very uneven and great disparities exist between the more urbanised and industrialised north of the country, and south Mexico. The fraction of the population living in rural areas (defined by the Mexican authorities as localities with less than 2500 inhabitants) is less than 22 percent in the states bordering U.S.A., whereas it rises to more than 44 percent in Oaxaca, Guerrero, Chiapas and Tabasco (INEGI 2001a). Great variations in terms of public services are observable among the 32 states of the country. Northern Mexican states reach high sewer coverage (Aguascalientes: 89.8%, Coahuila: 89.3%, Distrito Federal: 96.8%, Nuevo Leon: 90.9%) while less than half the population of southern States has access to this service (Yucatan: 43.3% Chiapas: 51%, Guerrero: 46.2%, Oaxaca: 40.7%)(CNA 2000).

Mexico is a good example of what can be observed elsewhere in developing countries. Sanitation development is considered synonymous with sewer system extension and the construction of centralised wastewater treatment plants. It is hardly present at all in rural areas. Most of the urban effluents collected in the sewer systems are discharged untreated into the environment, contaminating precious surface and groundwater resources. As a consequence, surface waters used for irrigation in agriculture usually contain high levels of faecal contamination, which can directly affect the health of the population (Chesnot and Lemoigne 1998). Although a wide diversity of wastewater treatment technologies are represented in Mexico, from the simple and robust stabilisation pond to the more sophisticated high-rate activated sludge systems, most plants operate far below their optimum efficiency, and many of them are abandoned.

#### c) Future trends in sanitation development

Due to population growth and the current rate of sanitation facilities provision, most scenarios for the evolution of sanitation in developing countries do not convey a feeling of optimism. During the last decade, the overall sanitation coverage for Africa, Asia and Latin America and the Caribbean slightly increased by 9 percent, but at the same time, it is estimated that the global population increased by 15 percent. Though improved sanitation access was provided to an additional 747 million people, overall, the increase of people served was just sufficient to keep pace with population growth. Global

population projections suggest that the world population of 6.055 billion in 2000 will increase 20 percent by 2015, and 30 percent by 2025 to 7.825. There will be enormous strains on services which are already overwhelmed, especially in urban areas and in Africa, and substantial further service provision will be needed to meet the population increase and address the backlog (WHO and UNICEF 2000).

### 1.3. Modes and rates of sanitation development

#### a) Preamble

The first two sections of this chapter briefly outlined the state of sanitation in western societies and in developing countries, focusing on Mexico. This comparison should convey the sense that the level of sanitation is more advanced in western societies, since developing countries appear to follow, unevenly and at a slower pace the development path that western countries pioneered. Evaluating and comparing the state of sanitary conditions in rich and poor countries according to western criteria was not considered to be relevant to this study. However, as the focus is on the processes by which sanitation develops this section takes a look at the forces that have shaped sanitation development in the West and that might also influence the change in poorer countries.

#### b) The sanitary revolution

The middle of the 19<sup>th</sup> century saw the advent of the sanitary revolution in the West. Industrialisation had caused rapid urbanisation and the sanitary conditions in industrial towns were appalling. City streets were often used as sewers and open drains. Outbreaks of cholera ravaged Europe in the early 1830s and late 1840s and were especially rampant in the overcrowded cities. In his famous *Report on the Sanitary Conditions of the Labouring Population of Great Britain*, first published in 1842, Edwin Chadwick concluded that the primary measures to improve the sanitary conditions of the people are 'drainage, the removal of all refuse of habitations, streets, and roads, and the improvement of the supplies of water' (Chadwick 1965). Chadwick's 'sanitary idea' convinced Britain that controlling the social environment through better hygiene could suppress the forces of disease (Dubos 1951). In 1854, Snow demonstrated that polluted water could spread cholera, but the science of water analysis was still uncertain (Hassan 1998). Professional chemists still lacked the scientific knowledge to prove that filthy water was bad for health (Hamlin 1990). The 'sanitary awakening' continued with the

very significant scientific discoveries in the field of microbiology, demonstrating the need for public health reform. Louis Pasteur's germ theory, published in 1878, led to a better understanding of the conditions under which host and parasite come into contact, permitting the formulation of rational and more effective control policies (Dubos 1951).

At the end of the 19<sup>th</sup> century, major civil engineering projects, such as those undertaken by Bazalgette to cope with the 'Great Stink of London' (i.e. the River Thames functioning as an open sewer) (Halliday 1999), introduced sewer networks in the major European cities. The extension of urban sewer and water supply systems, combined with improvements to the design of water closets accelerated the shift from filthy cesspools to water closet 'flush' systems (Hassan 1998). At that time, sanitation development principally occurred in urban environments, where sewer networks were extended. The combination of flush toilets and sewer systems used water in large quantities to remove excreta and the associated faecal pathogens from human settlements. In small towns and rural areas, sanitary infrastructure developed at a much slower rate. At the beginning of the 20<sup>th</sup> century, people's awareness of the health and environmental impacts associated with the increasing discharge of sewage directly into streams led to the development of sewage-treatment facilities. The septic tank was introduced during the same period, as a means of treating domestic sewage from individual households both in suburban and rural areas. Sewage treatment remained a neglected sector over the first half of the 20<sup>th</sup> century, resulting in severe deterioration of river water quality (Hassan 1998). 'Between the wars sewage treatment moved into the modern age, scientific thinking added technology to art and habit, and most of the principles of modern sewage treatment were established' (Sidwick and Murray 1976). At the end of the 20<sup>th</sup> century, the significant progress achieved in water treatment processes (micro/nano-filtration, ozone/UV treatments) allowed surface water partially contaminated with treated sewage to be used as a safe source of drinking water supply.

From a global perspective, the scientific discoveries of the late 19<sup>th</sup> century allowed the sanitary revolution to take place. Population growth and the urbanisation crisis during the industrialisation era triggered state intervention with sanitation control policies to eradicate the plagues that decimated part of the population. In Britain, the Victorian state's view was that proper water and wastewater management was crucial for Britain's imperial and industrial power (Walvin 1988) and that social reforms were necessary to

avert revolutionary uprisings (Timimi 1999). The initial endeavours to improve sanitation and hygiene were a response to the threats of epidemics to urban populations. However, the continuous development of sanitary conditions in western societies during the first half of the 20<sup>th</sup> century through new sanitation technologies, major civil engineering projects, and hygiene regulations can also be seen as an instrument of the State to improve workforce productivity, thereby fostering economic growth.

c) Sanitation in the Third World and development policies

Nothing comparable to the European sanitary revolution of the 19<sup>th</sup> century has occurred in Africa, Asia or Latin America. The socio-economic contexts in these regions of the world, with low levels of urbanisation and industrialisation did not urgently require better sanitation. The focus on sanitation development in the poorer countries is much more recent. Although during the first half of the 20<sup>th</sup> century water supply and sewer networks were installed in the major cities of developing countries, it was not until the late 60s that water management and sanitation (especially water supply) became a real concern for their governments. This process was largely the result of the institutionalisation of development policies after the Second World War. The conference of Bretton Woods led to the creation of the I.M.F. and the I.B.R.D. (i.e. the World Bank) to reconstruct the western economies and support development in the rest of the world. One vision was that development was mutually beneficial for the developing countries and for the industrialised nations looking for expanding markets (Brandt 1980). Additionally, in the context of the Cold War, the two blocks supported the development of poorer countries so to strengthen their influence in all the regions of the world. It would be cynical to exclude ethical considerations from the set of economic and political motivations to provide aid to the Third World. Development policies were also built on western morals and values advocating participation of the richest countries in the improvement of the conditions of life of the rest of the world.

The dismemberment of the European colonial empires slightly modified the nature of relationships between the former colonial powers and their new economic ‘partners’. During the 1960s, the eradication of world poverty via development was regarded as the post-colonial mission (Black 1998). Consequently, the present state of sanitation in most developing regions of the world is not the product of autonomous forms of

development. The influence of the West, and the U.S.S.R. to a lesser extent, were very significant in this process, which partly explains why sanitation in the Third World appears as an incomplete version of what was accomplished in the West. The role played by the West in the development of water and sanitation in developing countries has been and remains very influential. The next section briefly examines the sequence of events that shaped these development policies and evaluates their results in terms of enhancement of sanitary conditions.

## ***2. 40 years of water and sanitation development programs***

### ***2.1. A brief history***

During the 1960s, the development approach followed by the West was based on transfer of technology and resources, along the classic lines of the Marshall Plan, to foster economic growth in developing countries (Carmen 1996). At the end of that decade, this strategy was widely challenged, as it became clear that it had not had a significant impact on poverty reduction (Carmen 1996; Black 1998). The deficiency of these development policies was stressed by a series of water crises in the context of rapid population growth (Ghosh 1999). Among the failures of the development model, NGOs and some international organisations pointed out the inappropriateness of purely engineering solutions to water and sanitation issues, often characterised by a gross mismatch between sophisticated technologies designed in the West which were not adapted to the local contexts (Black 1998). New models providing more space for community involvement (i.e. Participatory Development, Basic Needs Approach) were applied during the 1970s, as alternatives to the top-down development policies which had proved inefficient in bringing development to the most needy people (Carmen 1996).

A series of U.N. conferences explored the controversies surrounding the development strategies in force, among which the World Water Conference in Argentina in 1977 came as a milestone in redefining the development approach of the West on water issues (Black 1998). As a result of the conference, the Declaration of Mar del Plata launched the International Water Supply and Sanitation Decade (commonly referred as 'The Water Decade'). The 1980s were to be a decade of collaborative ventures aiming at the

goal of 'Water and Sanitation for All', notably through the joint UNDP-World Bank Water and Sanitation Program. The 'Water Decade' demonstrated a shift from previous development strategies, with the introduction of low cost affordable technologies, and with a greater focus on capacity building and community participation (Black 1998; Ghosh 1999).

The Global Consultation on Safe Water and Sanitation in New Delhi in 1990 closed the Water Decade. The international community reaffirmed its commitment to provide, on a sustainable basis, access to safe water in sufficient quantities and proper sanitation. The conference of New Delhi ended with the formation of the Water Supply and Sanitation Collaborative Council, an international organisation aiming to 'enhance collaboration in the water supply and sanitation sector, specifically in order to attain universal coverage of water and sanitation services for poor people around the world' (WSSCC 2001). In 1996, the World Water Council, another international institution, was founded to identify and raise awareness on critical water issues, provide advice and information, and organise forums to arrive at a common strategic vision on integrated water resources management (World Water Council 2001). Concern for the water and sanitation crisis was definitely raised during the 1990s, through a large number of conferences and world summits, with the creation of new international institutions and new strategic plans (e.g. Agenda 21, Vision 21), contrasting nonetheless with a reduction in actual investment in water supply and sanitation (Ghosh 1999).

## 2.2. Evaluation of three decades of water and sanitation programmes

The previous section showed a significant rise in awareness of the widespread water and sanitation crisis. At the end of the 1970s, the Water Decade was launched to deal with this severe crisis, with the aim of providing safe water and sanitation for all. As a result, there was a major increase in the rate of service provision (WELL 1998). Indeed, every day in the 1980s, about 200,000 and 80,000 people respectively gained access to a safe water supply and proper sanitation facilities (Appleton and Black 1990). Nonetheless, it made little impact on the huge backlog of communities lacking basic water and sanitation services (Missen 1990; Black 1998), as at the end of the Water Decade the population without access to sanitation had increased by 300 million (Appleton and Black 1990). While much has been learnt during the Water Decade, its results look grim

when compared to the unrealistic 'water and sanitation for all' target. Indeed, although water and sanitation has been a top priority in international debates since the late 70s, there was little increase in the absolute investment in the sector (Ghosh 1999; World Bank 2001a). According to Khan (1997), the Water Decade became the 'Lost Decade' of development, as many poor countries were overwhelmed by payments of huge international loans.

The efforts of the international community were pursued during the 1990s, resulting in a slight increase in the proportion of people with access to safe water, while access to sanitation decreased (WELL 1998), dropping from 36 to 34 percent, as investments in sanitation declined and population increased (Perez 1999). 'Since 1990, an additional 300 million individuals are making do without decent sanitation, an ominous indication that the world community is failing in its efforts to provide services where they are most needed' (Khan 1997). The phenomenon of urbanisation continued in the developing countries during the 1990s. Urban dwellers represented 47 percent of the world's population in 2000. Sanitation coverage in rural zones remains generally lower than urban coverage (WHO and UNICEF 2000). Two-thirds of the rural population of the developing regions of the world make do without proper sanitation facilities (WHO 1997) because poor sanitation is not considered as a serious threat to life and health except in areas of extremely dense habitation (Missen 1990; Black 1998). WHO and UNICEF (2000) report that if they were continued, the development strategies followed during the 1990s would inevitably lead to increasing gaps between rural and urban zones.

Again, the efficiency of current development policies is widely condemned (Burgers 1999; Cosgrove and Rijsberman 2000), and the World Water Council (2000) indicated that drastic changes are required to prevent water shortage and environmental degradation becoming the norm (World Water Council 2000). Despite the rising concern of the international community about the water and sanitation crisis and the billions of dollars invested during the last two decades in the poorer regions of the world, the grim picture of sanitation today contrasts with the optimism which the inception of the Water Decade generated. In many countries, the future actually seems more uncertain now, as ongoing groundwater depletion and contamination reach levels that severely imperil the longlasting survival of human settlements. What can explain

this continuous failure to provide better sanitary conditions to a large part of the world population?

### ***3. Recognising the complexity of the problem***

#### **3.1. Generic causes**

The lack of success of the international community in developing sanitation represents a major problem for all the organisations committed to offering ‘safe water and sanitation for all’, which they view as a major step towards poverty eradication. In the last four decades, most NGOs and public organisations involved in development have progressively dismissed the purely engineering approach typical of the post-colonial era, and have come up with a wider picture of the problem, identifying a series of generic causes to explain this consistent failure. Unfavourable political and economic contexts, population growth, lack of appropriate technology, lack of community involvement, and many other issues were found to hinder sustainable sanitation development.

In 1992, in a report for a WASH (USAID) project, the research team identified over 20 planning, technical, institutional, legal, economic and financial issues/constraints related to wastewater reuse in developing countries (Bendahmane 1992). More recently, a report from the World Health Organisation and UNICEF (2000) listed ten major constraints on water and sanitation development: financial difficulties; institutional problems; inadequate human resources; lack of sector co-ordination; lack of political commitment; insufficient community involvement; inadequate operation and maintenance; lack of hygiene education; poor water quality; insufficient information and communication (WHO and UNICEF 2000). These extended lists of issues or constraints suggest the complex nature of sanitation development, an issue which was traditionally addressed essentially by means of technical assistance (Liebler 1994).

#### **3.2. Technology as *part* of the solution**

As mentioned in section 2.1, the 1970s saw the increasing disapproval of the public with regards to the development strategies devised by the national and international bodies framing the development policies in the Third World. A significant part of the criticism was (and continues to be) based on the denial of the strictly civil engineering



approaches used to improve water supplies and sanitation facilities. Indeed, Ghosh (1999) disapproves of the fact that water and sanitation development was assigned to a traditionally male dominated and engineering oriented water sector, which has 'possibly too long lived in its own world'. While Burgers (1999) wonders if the urban engineer is not chiefly responsible for the 'abysmal state of affairs', DFID reckoned in a recent report that many public health engineering projects failed because the technology transfers were not accompanied by measures to sustain their adequate use (WELL 1998). It becomes clear that neglect of the behavioural aspects, when construction and technology are the main focus, hinders the proper use and maintenance of the facilities built, and little or no health impact can be realised (Favin and Bendahmane 1999; Perez 1999).

Despite all the lessons learned since the launch of the Water Decade, the technology centred approach still prevails in a large number of water and sanitation projects (Ghosh 1999; Perez 1999). The growing awareness within international organisations and NGOs of the need to consider technology as only part of the solution has not been accepted with as much enthusiasm by all the institutions and politicians governing the developing countries. In addition to 'the resistance of the engineering establishment, given the incentives surrounding lucrative national and international contracts for high-tech installations and equipment' (Black 1998), politicians need quick results, which are not compatible with the complex and lengthy process of community participation and capacity building (Ghosh 1999).

### 3.3. New perspectives on water and sanitation development

Critics of the engineering focused approach and the reconsideration of development strategies by most international development bodies opened many new perspectives on how to tackle the water and sanitation issue more efficiently. The problem started to be analysed through the interaction of technical, managerial and human factors. The provision of services was no longer seen as a construction job only, but as a task that also involved social, cultural, institutional and political dimensions, which were extremely important and much more sensitive to address (Black 1998).

During the 1980s, Liebler (1994) reports that the professionals involved in the WASH programme (USAID) learned much about the institutional requisites for long-lasting

improvements in water and sanitation. The teams had to embrace a much wider range of specialities than that required for purely technical assistance. 'Our landscape has become much more varied, [...] as we explore various levels of involvement with the private sector, and as we discover the links between water and sanitation and other environmental health problems' (Liebler 1994). The DFID cycle for water and sanitation programmes and projects, as presented in a recent guidance manual (1998) is based on the recognition of the various dimensions of the project. This involves the identification of seven perspectives, namely: social perspectives; water, sanitation and health; environmental perspectives, economic perspectives, technical aspects; and hygiene promotion and sanitation promotion. DFID also suggests that 'an integrated approach is required to develop suitable infrastructure by integrating the social, health, technical, economic, financial, institutional, and environmental aspects and planning for sustainable management, operation and maintenance' (WELL 1998).

The term 'participatory approach' became a leitmotiv in development strategies during the 1970s. Its roots can be traced back to the 1960s, when USAID, the World Bank and other development bodies attempted to shift from their failing policies. Since then, the popularity of participatory approaches has kept on rising. The World Bank defines participation as 'a process through which stakeholders influence and share control over development initiatives and the decisions and resources which affect them' (World Bank 2001b). Although the chief aim of participatory approaches might not always be achieved, this process favours communication between the 'developers' and the beneficiaries', leading to the collection of a wide range of information valuable from social, cultural, political and institutional perspectives. The participatory approach can thus be regarded as an attempt to deal with development from a multi-dimensional perspective, and its popularity confirms that the trend in development strategies has been towards encompassing the complexity of water and sanitation issues.

### 3.4. Facing the complexity of the sanitation issue

Multidisciplinary approaches have emerged as a means of assessing the increasing complexity of the information gathered to promote sound development. Participatory approaches have stressed the need for composite teams in water and sanitation projects. Reporting on the evolution of WASH projects funded by USAID, Liebler (1994)

indicates that ‘technical assistance might include, in addition to an engineer, an anthropologist, an institutional development specialist, and an economist. She also suggests that the trend towards multidisciplinary is bound to intensify, as people become more aware of the complexities and inter-relatedness of water and sanitation issues. In addition to the redefinition of strategies and project methodologies to address water and sanitation issues in developing countries, some researchers have focused on the development of computer-based models to support the decision-making process. The emergence of these tools stems from the difficulty in dealing with the large number of issues now deemed relevant to sanitation development. Computer models such as SANEX (Loetscher 1999), and WAWTTAR (Finney and Gearheart 1998) both incorporate a vast number of variables associated with technical as well as social and cultural issues, and represent an innovative approach to dealing with the complexity of water and sanitation management.

Multidisciplinary team approaches and computer decision support models both reflect a great deal of evolution in the way water and sanitation issues have changed since the post-colonial era. Failures of the previous development models have forced national and international organisations to regard the problem as a complex one. The integration of social and cultural dimensions in water and sanitation development projects was a major step forward. However, despite these changes, the programmes deployed during the 1990s have not significantly improved the sanitary conditions of a major part of the world population. Furthermore, sanitation development seems a more complex issue than ever. Projects today are much more complicated and address many more issues in greater detail. As, Black (1998) puts it: ‘Each phase in the story of cooperation in water and sanitation has thrown up a new and seemingly more complex generation of challenges’.

However, should this idea of complexity be taken for granted? Does the failure of the international community to promote sustainable sanitation development necessarily mean that it is a too complex issue to tackle? And if it is, where does this complexity come from? Manifestly, lack of, or inappropriate sanitation, especially when combined with high population density, leads to a long chain of severe environmental and health problems. The complexity of sanitation development reveals itself in the chaotic consequences of its mismanagement. However, Esrey (1999) suggests that sanitation

development is not as complex as commonly thought, and our failure to deal with sanitation in a sustainable way mainly stems from a misperception of the function of excreta, seen as a waste instead of a resource. According to him, 'It is not waste that we should dispose of, rather the concept of waste' (Esrey and Andersson 1999). Thus, sanitation, the safe disposal of excreta into the environment, might not be such a complex issue. Some mind-boggling puzzles appear quite simple to solve when they are examined from the right angle. The limited success of the different strategies created by the international community to promote sustainable sanitation worldwide might essentially originate from a misconception of the problem. Would, as Esrey suggests, a change in the perception of excreta, from waste to resource make the problem any simpler? In my view, this shift is desirable, but it would not make the situation less complicated, because the complexity of sanitation development is intrinsically bound up with the fragmentation of thought and the associated segmentation of knowledge into separate disciplines. The next section examines these ideas in detail, starting with the observation that water supply and sanitation have traditionally been approached separately.

## ***4. A fragmented insight***

### ***4.1. Water supply vs. sanitation?***

The previous sections of this chapter often use the words *sanitation* and *water supply* together, suggesting that the improvement of sanitary conditions requires safe and sufficient water supply and vice versa. Typical diagrams representing the cyclical routes of waterborne pathogens and their impact on human health offer enough insight into the relatedness of water supply and sanitation to recognise that these two issues should be addressed as one (UNICEF 1995; Esrey 1996; Esrey *et al.* 1998). While the international community defines health improvement as a chief requisite for poverty eradication, numerous studies demonstrate that for greater health impact, water and sanitation schemes should be implemented together (Esrey 1996; Perez 1999). For example, a project focused on the provision of water supply, that neglects the issue of wastewater removal can result in the creation of standing water, thereby outweighing its positive benefits (Schertenleib 1999).

What seems obvious to hydrologists or epidemiologists has been consistently overlooked by development policy makers. Water supply has occupied a central position in the discourse of national governments and the international community, who 'have continued to ignore the clamour from the sector professionals for increased attention to sanitation for far too long' (WELL 1998). Although significant progress was achieved during the 1990s in terms of water provision services, this 'stands in stark contrast to the shameful failure in sanitation' (Khan 1997). Another vivid example of this striking resistance to deal with water supply and sanitation as inseparable issues to address population health is found during the recent UN General Assembly of September 2000. The 'Millennium Declaration' resolves 'to halve, by the year 2015, the proportion of people who are unable to reach, or to afford, safe drinking water' (United Nations 2000). However, as pointed out by the Global Water Partnership, the Declaration does not refer to the provision of sanitation and hygiene education (Global Water Partnership 2000).

#### 4.2. Sectoral segmentation

The fact that the 'Millennium Declaration' does not address sanitation development and hygiene promotion highlights the incapacity, rather than the unlikely (yet probable) lack of will, of the major development 'promoters' to view water supply, sanitation, and hygiene as aspects of a single issue. They are facets of the same objective viewed from different perspectives. The fragmentation of this issue into two distinct components addressed separately, with varying degrees of commitment for each, considerably reduced the efficiency of all the programmes oriented towards health improvement. However, this fragmented approach to water supply and sanitation issues is not something that can be corrected easily, since it is the manifestation of the partitioned organisation of most institutions. In many countries, the water resources area is still dominated by the irrigation engineers, and bulk water supply by the economists (Ghosh 1999). In Mexico, the National Water Commission (CNA) is the main institution in charge of water resources. CNA traditionally focused on agricultural water management, and progressively got involved in community water supply. However, so far, they have had little interest in the protection of the groundwater recharge zones or sanitation (Fonseca 2000). CNA has departments that tackle specifically the sanitation issue, but the inertia of this big institution mainly composed of hydrologists and civil

engineers has continued to marginalise sanitation. Mexico is not an exception. The segmentation of water supply and sanitation issues tends to be the norm. In most countries water continues to be managed sector by sector by a highly fragmented set of institutions (Cosgrove and Rijsberman, 2000). Ghosh (1999) stresses that: 'sanitation literally is falling through the cracks, as any department or area does not own it. Even the Health and Population strategy of the World Bank does not even recognise the importance of sanitation' (Ghosh 1999). According to Laszlo (1996) the sectoral segmentation of the design and implementation of public policy is the manifestation of the obsolete worldview which prevails in western societies. He shows how governments and the UN deal with finance, trade, defence (security), development, social justice and the degradation of the environment as if they were independent issues. 'Even when an issue cuts across the fields of competence of several agencies-such as education [...] -the separation of mandates encourages bureaucratic narrow-mindedness and in-fighting, with the result that, instead of joining forces, territories are insistently claimed and jealously guarded, and the available funds are intensely fought for (Laszlo *et al.* 1996).

#### 4.3. The fragmentation thought-process

Ultimately, this situation may be the result of classical academic education, characterised by clear-cut and hermetic barriers between disciplines. Specialists are trained to view the world according to the perspective of their chosen disciplines, and hydrologists and economists have not been encouraged to view the connections between water supply, social behaviour, culture, hygiene and sanitation. With the exception maybe of a few isolated 'primitive' tribes, most modern societies draw sharp distinctions between art, science, technology and religion. The physicist David Bohm (1980) notices that human work is generally divided up into specialities, each considered distinct in essence from the others. In a desperate effort to unite these disciplines, people have created further interdisciplinary subjects, which have ultimately served mainly to add further separate fragments. In his book about science and creativity in the Third World, Goonatilake (1984) explains that the socialisation process in universities and schools tends to stultify creativity. Students and researchers learn to see knowledge as divided into separate disciplines. 'Clearly the conventional socialisation process [...] is programmed to create routine robot-like responses' (Goonatilake 1984).

In that respect, the failure of the approaches to water and sanitation development finds a counterpart in the limits of modern western medicine. As the water and sanitation issue is divided into several aspects (groundwater supply, river water quality, hygiene, excreta disposal and removal, wastewater treatment and reuse...) addressed separately by different specialists, the same thing occurs with the human being in medical sciences. Modern medicine draws separations between the biological and psychological dimensions of man, and when bridges between these two dimensions are recognised, as in the case of psychosomatic illness, they are 'compartmentalised away in domains such as psychology, psychiatry or neurology' (Pieterse 2001). Further fragmentation can be observed in the biological dimension: the physical body is sliced up and each compartment is approached by a number of disciplines, such as dermatology, gastroenterology, haematology, neurology, ophthalmology, or gynaecology, and many more, each of them offering their 'pills' and remedies to treat specific symptoms. The analogy with sanitation is striking here: sewer systems are built to remove the pathogens from the population, and as river water quality declines (symptom), new chemical processes are incorporated in wastewater treatment plants, and palliative measures - so-called 'end of pipe' solutions- are developed to deal with the potentially harmful sludge produced.

Fragmentation extends far beyond the mere division of work into several disciplines. Accordingly, man's natural environment is viewed as an aggregate of separate parts, to be exploited by different groups of people. The existence of separate nations and religious divisions, to which man gives supreme importance, is entirely the product of our thinking (Bohm 1996). The history of sciences provides some explanation of this compulsive force. Ultimately, this urge to view things as separate may stem from the atomic theory, which was proposed by Democritus more than 2000 years ago. Although looking at the world as constituted of atoms was in certain ways 'an important mode of realisation of wholeness, [...] it ultimately became a major support for a fragmentary approach of reality (Bohm 1996). The work of Newton and Descartes greatly contributed to reinforcing the idea that life can be perceived as a big machine made of separate things that can be studied and understood independently. The illusion that the world consists of independently existent entities is now so deeply rooted in people's thought that it affects the way they interact with their natural and social environment.

#### 4.4. The strengths and weaknesses of fragmentation

The fragmentation thought-process described in the preceding section should not be condemned or rejected. Fragmentation can be seen as a natural process in the development of humanity. Indeed, 'man's first realisation that he was not identical with nature was also a crucial step in his thinking, which allowed him to go beyond the immediately given limits of nature, first in his imagination and ultimately in his practical work' (Bohm 1980). Dividing and separating things was both useful and necessary for humankind to deal with its constraints in manageable proportions. Developing new tools, building shelters, or farming, required rational thinking and a focus on certain aspects of reality. Similarly, the distinction of different sub-issues within the problem of water and sanitation development is necessary, simply because people cannot deal with the whole of this complex issue at once.

The problem does not fundamentally stem from this fragmented perception, but rather from the belief that this representation *is* reality. Theories are worldviews that describe certain aspects of reality. The atomic model and the Newtonian and Cartesian mechanistic worldviews proved extremely useful because they were so appropriate to describe people's common experience. Nonetheless, the awareness that 'the world constituted of separate fragments' was essentially a useful model has been lost. The existence of all the divisions and separate entities created by the thought (to deal with practical issues) is now taken for granted. The fact that people's thoughts and images represent reality is unquestioned and as Bohm puts it:

'If you view the world as fragmented you can't do else than act accordingly bringing more chaos. [...] this illusion cannot do other than lead to endless conflict and confusion. Indeed, the attempt to live according to the notion that fragments are really separate is, in essence, what has led to the growing series of extremely urgent crises that is confronting us today' (Bohm 1980). From a completely different professional background (management), Peter Senge (1992) basically reaches the same conclusions: according to him, the compartmentalisation of knowledge creates a false sense of confidence. 'The traditional disciplines that influence management [...] divide the world into neat subdivisions [...] But the boundaries that make the subdivisions are fundamentally arbitrary [...] Life comes to us as a whole. It is only the analytic lens that



we impose that makes it seem as if problems can be isolated and solved. When we forget that it is only a lens, we lose the spirit of openness (Senge 1992).

The limits of a fragmented worldview in the context of sanitation were briefly outlined in the preceding section. Typically, some aspects of the water and sanitation issue are perceived as if they had a separate existence, which entitles them to be independently addressed. As a consequence, some parts of the problem are often managed without taking into consideration their interconnectedness (e.g. links between water supply, hygiene and sanitation). While this lack of awareness in water and sanitation projects usually manifests itself in a mediocre achievement of the objectives, the side effects of such fragmented approaches are sometimes dramatic. The ‘flush and forget’ approach to sanitation is a good example of how solving part of the whole issue (in that case, domestic effluent removal) can have disastrous effects on the rest of the system. It disregards water availability status and wastewater treatment requirements. In many regions of the world, including most of Mexico, ‘flush and forget’ approaches dramatically increased the stress on groundwater resources, both in terms of quality and quantity, since sewer system discharges in the environment eventually contaminate the aquifers (Esrey *et al.* 1998; Del Porto and Steinfeld 1999). According to Pieterse, ‘Reductionism along with disciplinary fragmentation made expert regimes and technocratic interventions possible, and has generously contributed to development policy failures’ (Pieterse 2001). Arguably, the fragmented perception of water and sanitation issues is a major factor in the failure of the international community to improve the sanitary conditions of a large part of the world’s population during the second half of the 20<sup>th</sup> century. According to theoretical physicist Capra (1997) the major problems faced by humanity since the Cold War, such as resource scarcity, environmental degradation, the breakdown of local communities and ethnic and tribal violence need to be seen as different facets of one single crisis, that stems from a misperception of reality. Thus, in my view, the complexity of sanitation development largely stems from this fragmented view of the world and the use of distinct disciplines to address separately the various facets of the problem.

## **5. Paradigm shift**

### **5.1. The end of the mechanist worldview**

The development of thought fragmentation and the subsequent sectoral segmentation of work have been significantly favoured by the Cartesian mechanistic worldview of western societies. The medieval notion of a living, organic, spiritual universe was replaced by the world-machine model brought about by the Scientific Revolution (Capra 1997). Galileo restricted science to the study of quantifiable phenomena. Descartes created the method for analytical thinking, which consists in breaking down complex phenomena in smaller parts, the properties of which permit us to understand the behaviour of the whole. Newton's laws of motion and gravity successfully completed this world-machine framework. Newton's principles were deterministic and universal, providing clear and indisputable knowledge of the world. This modern paradigm confirmed the universal correctness of the atomic view. It was rapidly adopted by the Europeans who could recognise their own experience in this model, and by the United States, who could increase their power, through major technology developments (Laszlo *et al.* 1996).

The first opposition to the Cartesian worldview was found in the Romantic movement in art, literature and philosophy in the late eighteenth and nineteenth centuries. This was followed by the development of organismic biology, shifting from function to organisation in physiology, a shift from mechanistic to systemic thinking, focusing on the relationships between the parts, rather than on their properties (Capra 1997). This work set the basis of systems thinking. According to the systems view, the essential properties of a living system, e.g. an organism, an organisation or a society, are properties of the whole, which arise from the interactions and relationships between the parts. This represented a radical shift from the Cartesian paradigm, according to which the behaviour of the whole could be understood entirely from the properties of its parts (Capra 1997). Ecology enriched systems thinking with the concepts of community (i.e. an assemblage of organisms bound into a functional whole) and network (e.g. food chain network) (Capra 1997). The radical discoveries of quantum physics at the beginning of the 20<sup>th</sup> century struck major blows against the Cartesian paradigm. Physicists discovered that 'Newtonian physics does not work in the realm of the very

small' (Zukav 1980). Quantum physics showed that ultimately there are no things, no parts, but merely 'a pattern in an inseparable web of relationships' (Capra 1997).

## 5.2. Holistic approaches

Systems thinking and systemic models continued to develop during the second half of the 20<sup>th</sup> century and a coherent theory of living systems expressed through mathematical language is now emerging. The new paradigm, the holistic view, presents the world as an integrated whole, rather than the sum of its parts taken in isolation (Capra 1997). As values represent a driving force of science and technology, Capra notices that the new paradigm involves a transition in the mode of thinking and in the set of values from a self-assertive tendency towards an integrative one. These changes are presented in Table 2.1.

Table 2.1. Towards integrative thinking and values

| Thinking              |                    | Values                |                    |
|-----------------------|--------------------|-----------------------|--------------------|
| <i>Self-assertive</i> | <i>Integrative</i> | <i>Self-assertive</i> | <i>Integrative</i> |
| Rational              | Intuitive          | Expansion             | Conservation       |
| Analysis              | Synthesis          | Competition           | Cooperation        |
| Reductionist          | Holistic           | Quantity              | Quality            |
| Linear                | Non-linear         | Domination            | Partnership        |

(Capra 1997)

Capra points out that the self-assertive values are generally associated with men. Western societies are patriarchal, men hold most of the power and are economically better rewarded than women. This represents a great source of resistance for societies to accept this shift of values. Power, in the sense of domination over others, is replaced in the new paradigm by power, in the sense of the influence of others, which expresses itself at best in network systems, rather than in hierarchical structures (Capra 1997). And at a deeper level, the change of manifestation of power will support ecocentric (earth-centred) values, as opposed to the prevailing anthropocentric perspective with its life-destroying side-effects (Capra 1997). This latter concept, central to environmental philosophy, was supported with a powerful set of arguments by the work of Lovelock (Lovelock 1987) and his famous Gaïa hypothesis.

In holistic approaches, the qualitative description of the relationships framing the system is more relevant than the quantitative assessment of the properties of its

component parts. The focus shifts from the measurement of objects and their properties to the quality of their interconnections, and to the observation of patterns. There is another fundamental feature attached to the holistic view: knowledge, which could be regarded as a building standing on a solid physics basement, is now a network. Systemic approaches look at living systems as networks, and consequently 'our descriptions, too, form an interconnected network of concepts and models in which there are no foundations' (Capra 1997). In a certain way these ideas are relevant to the problem of sanitation development. Indeed, sections 3.1 and 3.2 of this chapter described a shift from purely engineering approaches, principally based on so-called 'hard' (natural) sciences, to multidisciplinary approaches, allowing more space for 'soft' sciences, more focused on the qualitative nature of the relationships between people and their culture, as well as their political and institutional organisation. This gradual process is arguably a manifestation of the transition from 'knowledge as a building with strong physics foundations' to 'knowledge as a network'. In this process, the soft vs. hard science dichotomy is likely to vanish as the different sources of knowledge will be viewed as interacting within a network rather than gradually stretched along an axis with, at one end the hard, objective sciences and at the other end of the spectrum the subjective, soft sciences.

Objectivity is a very sensitive issue in the holistic paradigm. The Cartesian model presented the world as a great, impersonal machine, thus creating the illusion that absolute objectivity was achievable, and encouraging the scientists to strive for it (Zukav 1980). But at the subatomic level, observer and observed merge and to speak of the interaction of 'observing instrument' and 'observed object' has no meaning (Bohm 1980). 'The new physics tells us clearly that it is not possible to observe reality without changing it' (Zukav 1980). This has some clear implications for scientific investigation, notably in social sciences. The illusory quest for absolute objectivity has to be abandoned and replaced by approaches that recognise subjectivity as part of the research process and that try to identify and 'control' the sources of subjectivity in a transparent way.

### 5.3. The need for holistic approaches

Jan Pieterse (2001) stresses the multi-dimensional nature of the development process. It takes place on a physical level, in a political field, a historical context, on moral and mental planes, and in a universe of meaning, influenced by shifts in social relations and emotional landscapes... which cannot be fully encompassed by the 'Cartesian and Newtonian matrix of knowledge' (Pieterse 2001). Although holistic approaches are by no means the ultimate tool to understand the complexity of development processes, they are very relevant to address these issues.

The analysis of the discourse used at the turn of the 20<sup>th</sup> century by the major national and international bodies involved in development of the Third World reveals features that are characteristic of the paradigm shift described in section 5.1. For instance, The French Foreign Affairs Ministry and DFID both stress the need to adopt more integrated, synthetic approaches (WELL 1998; Ministere des Affaires Etrangeres 2001). The Swedish International Development Agency commits itself to following holistic approaches (SIDA 2001b) and shifts gradually towards a less anthropocentric position (like many other governments) by setting 'the long term sustainable use of natural resources and protection of the environment' as one of its overall goals (SIDA 2001a). Similarly, the British Department for International Development supports the use of systemic approaches: the Sustainable Livelihoods framework is defined as a holistic approach, which 'helps to organise the various factors which constrain or provide opportunities and to show how they relate to each other' (DFID 1999).

The discourse of these governmental bodies shows a willingness to change the way of thinking, and moreover, is associated with a set of integrative values. More partnership and cooperation are sought. Most governmental agencies and international bodies involved in development underline the need to foster the participation of all the stakeholders in the programmes launched. Gender issues, and the willingness to balance the relations of power between men and women permeate the discourse of these institutions (WELL 1998; German Federal Ministry for Economic Cooperation and Development 2001). The notion of sustainability, omnipresent in the development discourse, denotes a gradual shift from expansionist to conservationist values.

Arguably, all these concepts and values are often used as trendy catch-phrases both by the governments and donor organisations wishing to make their public image as good as possible, and by the myriad of organisations engaged in fierce competition for project funding. The commitment to adhere to these leitmotiv concepts and values does not always match the behaviour of these organisations in real life. However, even though there is still a great resistance to shift from patriarchal domination forms of power to gender inclusive 'network-influence' types of power, the current political messages of western nations clearly denote an ethical drive to adopt these values, at least in the long-term.

In the field of water and sanitation, this shift of values and thinking is already well established, probably because the multidimensional nature of water issues is more obvious than in other aspects of development. Water catchment management, for instance, provides a framework for the synthetic approach of water management. The stakeholders' representation also marks a shift from top-down policies to a form of power distributed in the stakeholder network. The great majority of water and sanitation programmes in developing countries integrate gender issues, sustainability, multidisciplinary and the idea of cooperation and partnership. The discourse used at the end of the 20<sup>th</sup> century particularly underlined the need for holistic (or systems) approaches:

'The need for holistic and integrated planning has been insufficiently recognised' (Schertenleib 1999).

'A holistic, systemic approach relying on integrated water resource management must replace the current fragmentation in managing water. Business as usual with sectoral fragmentation must be avoided in the follow-up process' (World Water Council 2000).

'An integrated approach is required to develop suitable infrastructure by integrating the social, health, technical, economic, financial, institutional, and environmental aspects and planning for sustainable management, operation and maintenance' (WELL 1998).

'The [2<sup>nd</sup> World Water Forum at the Hague] Forum introduced the concept of 'water security' as the central goal for future action and this term captures the complex concept

of holistic water management and the balance between resource protection and resource use' (Global Water Partnership 2000).

## **6. Aim & objectives**

This chapter outlined the background of this investigation, a context where the professionals of development perceive the complexity of water and sanitation issues, but also a context pointing out the obsolescence of fragmented approaches and the need to address sanitation development in a holistic way. The working hypothesis of this study is that the fragmented perception of sanitation development is a major cause for the failure of the international community to improve the sanitary conditions of a larger percentage of the world population. Sanitation development needs to be understood and tackled as a whole, in all its dimensions, rather than through independent projects dealing with separate parts of the issue.

- . **The aim of this research is to improve the understanding of sanitation development**, which will lead to more efficient and sustainable development projects.
  
- . **The first objective is to develop a holistic approach to the assessment of sanitation development.** In other words, a methodology needs to be designed to investigate the multidimensional nature of sanitation development. Part of this objective involves the development of a new means of representing the complexity and the interconnectedness of the factors influencing sanitation development.
  
- . **The second objective is to apply and evaluate this holistic approach in Mexican communities.**

## Chapter 3 - Methodology

### **1. Introduction**

The methodology was designed to meet the chief objectives of the study:

- To develop a holistic approach to the assessment of sanitation development.
- To apply and evaluate this holistic approach in Mexican communities.

Developing a holistic approach for the assessment of sanitation development requires the use of a methodology, which allows the identification of all the components of the sanitation development system and their interactions. In such a methodology, the choice of data collection techniques is crucial because information about all the aspects of the system is wanted. The way these techniques are applied is equally important: the researcher must keep focused on the interactions between the system components. A balance between conciseness and richness of the information collected has to be found, the priority being the understanding of the whole system. Lastly, the means of representing the system has to be chosen so that it communicates the characteristics of a holistic approach, while providing a vivid description of the system.

The first part of the methodology, namely the data collection, was designed in Mexico, pilot tested and applied in situ in three case studies. This work lasted from June 1999 to January 2001. Section 2 describes the research design, the contribution of the pilot case study to the refinement of the methodology. The set of data collection techniques selected as part of the holistic approach are then listed. Finally, the reliability of the data collection process is discussed.

Section 3 describes how the data collected for the three case studies were analysed, organised and presented in an original way. This phase lasted approximately six months and was carried out in the UK.



## **2. Research design and data collection**

### 2.1. Research design

#### a) Qualitative research

A holistic approach is a systems approach that focuses primarily on the nature of the interactions between the system components. As explained in Chapter 2 such an approach is not chiefly concerned with the analytical description, accurate examination, or quantitative measurement of the properties of each part of the system. In the case of this research, the system consists of all of the factors that influence sanitation development. The methodology must allow the identification of these components and their relationships. The systems components are different (e.g. technical, social, cultural, institutional, economic) and qualitative methods of investigations were found most suitable to encompass the various dimensions of sanitation development. Although the methodology used in the first phase of this research is typical of qualitative research, quantitative methods were not completely rejected, since they produced some interesting information about the properties of some parts of the system.

This investigation uses the standard approach of case-study research, which helps researchers connect the micro level, or the actions of individual people, to the macro level, or large-scale social structures and processes (Neuman 1997). In this kind of research, many features of a few cases are examined in depth over a period of time ranging from a few months to several years. Cases can be individuals, groups, organisations, movements, events or geographical units. In this study, the case studies were three communities which were investigated over a period of 14 months.

#### b) System boundaries

##### • *Mexican communities*

The research was narrowed to the investigation of sanitation development in small communities. Cities are complicated systems to explore holistically. Attempting to understand in depth the complexity of sanitation development in such systems was deemed impossible, considering the time constraints of this study. Small communities of less than 4000 inhabitants were the focus of this research. The identification of the nature and impacts of the external influences on a small community is a much simpler and less time-consuming task than in a city.

• *Choice of the case studies*

There are two main reasons why the research was designed on the basis of several case studies. First, by using the same methodology in several case studies, the versatility and robustness of the approach can be tested against varying circumstances. Then, by replicating the same ‘experiment’ in several communities, the uniqueness of each situation can be determined. Consequently, some generalisations can be drawn, while respecting the distinctiveness of each community. This can be helpful in project planning, where strategies need to recognise the particularities of each site. Considering this, it was deemed appropriate to try the approach out on at least three case studies. Before the detailed case study investigation began, it was necessary to become better acquainted with qualitative methods of investigation. The first five months of work in Mexico were spent testing a range of methods in situ, in a pilot case study. This period led to the refinement of the holistic approach and enabled an estimation to be made of the duration required for each case study, taking into account the time required for data collection and the writing up of reports. Five months per case study was deemed an appropriate period of time. Consequently, due to time constraints, there was just enough time to undertake three case studies.

The choice of the case studies hinged on the premise that the validity and the robustness of the approach could be better assessed by applying the methodology in very different contexts. Consequently, the communities were principally selected on the basis of their diversity. Four criteria guided this selection process:

- Population size: small communities with less than 4000 inhabitants were considered.
- Sanitation infrastructures: communities using different types of sanitation infrastructure and facilities were selected (e.g. open-air defecation, pit-latrines, ecological toilets, sewer system, oxidation pond).
- Economic and sociocultural environments: communities with distinct sociocultural backgrounds were chosen.
- Institutional and political background: the diversity of the communities, in terms of their institutional and political organisation, was taken into account in their selection.

A very large number of Mexican communities meet these criteria and the case studies were often ultimately chosen on the basis of the advice of respected informants (e.g. NGO members, researchers). Additional information about the selection process is presented in Appendix 1.1. Table 3.1. outlines the characteristics of each case study. Roughly five months were spent in each of the four communities. El Copal (pilot case study) and Tepezalá are two rural communities located in Central Mexico, while El Mirador and San Luis Beltran belong to the peri-urban zone of Oaxaca City, South Mexico. The El Mirador case study was different because the community primary school was chosen to form the boundary of the system. The idea was to test the approach on a smaller scale. However, the approach was in practice just the same as in the other case studies, since the school had to be understood within the community and regional context.

Table 3.1. Case studies characteristics

| Case study                         | El Copal (pilot case study)                                                            | Tepezalá                                                                             |
|------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| State                              | Guanajuato                                                                             | Aguascalientes                                                                       |
| Population                         | ≈1100 inhab.                                                                           | ≈3500 inhab.                                                                         |
| Setting                            | Rural zone                                                                             | Rural zone                                                                           |
| Sanitation infrastructure          | On-site sanitation and off-site Imhoff tank/constructed wetland system in construction | On-site sanitation and sewer /oxidation pond with effluent reuse for crop irrigation |
| Political Background               | Community leader; Low community participation                                          | Municipal government                                                                 |
| Economic and sociocultural aspects | Various sources of employment; High cultural homogeneity                               | Very low economic activity; marginalisation of a part of the community               |
| Period of investigation            | June 1999 to October 1999                                                              | November 1999 To April 2000                                                          |

| Community                          | El Mirador (Morelos primary school)                                                             | San Luis Beltran                                                        |
|------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| State                              | Oaxaca                                                                                          | Oaxaca                                                                  |
| Population                         | ≈1000 inhab. (200 pupils)                                                                       | ≈1200 inhab.                                                            |
| Setting                            | Fast growing peri urban zone                                                                    | Rural village aside the urban zone                                      |
| Sanitation infrastructure          | Pit-latrines and sewer (primary school: two pit latrines)                                       | On-site composting sanitation system and sewer system                   |
| Political background               | Community division; two rival factions; low community participation                             | Community council; pre-Hispanic political customs; weakening leadership |
| Economic and sociocultural aspects | High poverty; high cultural heterogeneity; loose social fabric; mistrust amongst the population | Abandonment of farming activities; shift in cultural values             |
| Period of investigation            | May 2000 to September 2000                                                                      | October 2000 to January 2001                                            |

According to Neuman (1997) three factors are relevant when choosing a field research site: richness of data, unfamiliarity, and suitability. The population size of the community was the main indicator of suitability. The unfamiliarity of the sites (Neuman suggests that novice field researchers should always choose an unfamiliar setting, since it is easier to see cultural events and social relations in a new site) was not an issue since this investigation was the researcher's first experience in Latin America. The diversity of settings, sanitation infrastructure, sociocultural environments, and political and institutional backgrounds guaranteed a richness of data.

Setting the boundaries of the system clarified the aim and objectives of the investigation. The research was about improving the understanding of sanitation development through a holistic approach in the context of Mexican communities. However, qualitative research can seem somewhat fuzzy, and the process of case study research quite indistinct, to a scientist trained with an engineering background. A set of basic principles of qualitative research was thus used for guidance.

#### c) The guiding principles

In qualitative research, the research design is not regarded as a predefined, fixed framework to be strictly followed during the whole study. A field researcher does not begin with a set of methods to apply or an explicit hypothesis to test (Rubin and Rubin 1995; Neuman 1997). Rather, the research design has to be flexible and evolutionary, responsive to the new avenues of inquiry the investigation opens. Uncertainty is part of that natural unfolding process of the study. It is necessary as it allows the researcher to take new opportunities and redirect the investigation towards some unexpected themes (Rubin and Rubin 1995). Qualitative research is based on a firm methodology, but the methods and techniques can vary and are selected on the basis of their value for providing information in the specific context of the investigation (Neuman 1997). However, there are some key elements that characterise qualitative research design and this investigation strongly relied on three principles put forward by Rubin & Rubin (1995) in their book 'Qualitative Interviewing, The Art of Hearing Data': qualitative research designs must be *flexible*, *iterative* and *continuous*.

- *Flexible design*

Flexibility is a vital characteristic of qualitative research methodologies. Constant adaptation to the way the investigation naturally unfolds is required. Assumptions need to be suspended to remain sensitive to new concepts that emerge through the interviews (Rubin and Rubin 1995). Field researchers rarely follow fixed steps. In fact, flexibility is a key advantage of field research, because it allows to shift direction and follow leads (Neuman 1997). In the beginning, the researcher expects little control over data and little focus. Once socialised to the setting, however, he or she focuses the inquiry and asserts control over the data (Neuman 1997). In data collection through interviewing, flexibility means the possibility of adjusting the questioning, so that the interviewees are asked about the parts of the subject that they know best (Rubin and Rubin 1995).

Generally speaking, flexibility also meant that a certain level of uncertainty had to be maintained with respect to the planning of the research. As described in detail in Appendix 1.1, the case studies were not all chosen in advance, and were selected according to the interest they could represent in the unfolding context of the research.

- *Iterative design*

The process of collecting information, analysing it, identifying concepts, and testing them is cyclical (Rubin and Rubin 1995). At the beginning of the research, the idea is to get a general picture, and data collection methods are used to gather a wide range of ideas. At first everything seems relevant, then, selective attention focuses on specific questions and themes. As ideas emerge, they are examined in depth through more directed interviews. By refining these ideas, new concepts come out, which are relevant to the study and feed this cyclical process. As Neuman (1997) puts it, qualitative research is non-linear. It is 'more of a spiral, moving slowly upward but not directly. With each cycle or repetition, a researcher collects new data and gains new insights'.

The data collection phase is considered complete when each additional interview brings no significantly new concepts. In their 'Grounded Theory', Glaser and Strauss define this state of the research process as the 'point of theoretical saturation' (Glaser and Strauss 1967).

• *Continuous design*

Continuous design means that the work should be redesigned at several points in the research. The design is not restricted to its initial definition. Ideas can emerge in the first stages of data collection, which suggest the use of other techniques, or the interviewing of an unexpected group of people about an issue that was not addressed first, but which is relevant to the global purpose of the research.

d) *Fieldwork process*

The variety of the case studies prevented the data collection phase from being undertaken in a routine way. The research design for the three case studies agreed with the three basic principles previously mentioned, but the case studies were sufficiently distinct from each other to require a specific strategy. A number of steps were nonetheless consistently repeated. These successive steps form the procedure that was followed during the fieldwork. They involved, for instance, the development of first contacts with the local authorities, the search for key informants, the introduction of the research to the interviewee. The procedure also includes the unfolding of the fieldwork in each case study, starting with the production of a baseline study and then focusing on more specific issues affecting sanitation development. This sequence of steps that describes the fieldwork process is presented in more detail in Appendix 1.2.

## 2.2. El Copal: pilot case study

a) *Research cornerstone*

In several aspects the work undertaken in El Copal was the cornerstone of the study. The aims and objectives of the research were refined and the methodology for a holistic approach to the assessment of sanitation development was established after a wide range of data collection techniques were tested. This section explains how the first five months of the research in Mexico led to a better definition of the scale of the research. The methods that were evaluated are then examined in the light of the circumstances in which they were tested.

b) *Defining the research arena*

Research arena, topical arena, and cultural arena are terms used by Rubin and Rubin (1995) to characterise the subject under investigation. The research arena consists of the potential interviewees and the topics that are discussed with them. A topical arena

includes the people who are affected by a given topic or issue. A cultural arena includes those who have similar understandings, expectations and values. The pilot case study was an opportunity to become acquainted with these concepts, which proved to be useful in refining the scope and boundaries of the following case studies.

- *Topical arena*

The research is concerned with sanitation development; sanitation is here considered globally, as the ensemble of means to safely collect, dispose, and return excreta to the environment. The topical arena of each case study includes all those with a stake in community sanitation. It usually comprised the community dwellers, the local authorities, and the state and federal departments in charge of health, water issues, and civil engineering work. In some cases, additional stakeholders, such as NGOs or farmers reusing the wastewater, widened the topical arena. Each case study required all these stakeholders to be identified, since they represented the main source of information. In this respect, the time spent in El Copal provided me with the opportunity to become more familiar with the political organisation of Mexico and the various public institutions involved in the management of water and sanitation.

- *Cultural arenas*

It is essential to be sensitive to the diversity of cultural arenas, as this permits the researcher to identify the likely assumptions of a group of people, that is, the beliefs, rules, and sets of understandings that affect their world views. Considering the cultural gaps between different stakeholders or within the same stakeholder group allowed modification and adaptation of the questioning during the interviews. The distinction between cultural arenas is difficult for a researcher immersed for the first time in a foreign culture. The five-month stay in El Copal was valuable in order to acquire some reference points to differentiate one cultural arena from another. At the end of the El Copal pilot case study, my ability to converse with Mexican people had much improved and allowed me to perceive language subtleties and the implications of words and expressions in the conversations. This was crucial because I did all the interviews on my own, without the help of an interpreter. Enhancing my capacity to speak and understand the local language also improved my ability to define cultural arenas.

c) Testing data collection techniques

- *Literature review*

A substantial amount of information was gathered by reviewing literature concerning the El Copal community and its region. For instance, an official report diagnosing the hydrological situation of the state of Guanajuato was valuable to acquire some knowledge about regional characteristics of the natural environment, notably the hydrological background (CEASG 1999). The magazine Hydroplus (Nov. 1998 issue) was also a very useful source of information about the politics and water management strategies in Mexico and in the state of Guanajuato more specifically (Lemoigne 1998). A social survey undertaken during the spring 1998 in El Copal by students of the Institute of Food and Agriculture of the University of Guanajuato (Tiberghien 1999) also proved to be valuable for the research. Literature reviewing was a useful data collection technique, and provided a ready source of knowledge of the regional and local background.

- *Social survey*

A social survey usually takes the form of a questionnaire and results in a variable by case data matrix (Balnaves and Caputi 2001). The interviewers are trained to act in a uniform way with each research subject, and it is assumed that the influence of the interviewer on the results is negligible (Rubin and Rubin 1995). A social survey was designed and undertaken in El Copal to examine some water supply and sanitation issues (i.e. water sources, water quality and quantity, water uses, excreta disposal facilities...). In addition, this survey tried to evaluate the concern of the community members for the improvements needed in the village. 13 students of the University of Guanajuato participated in this fieldwork. The survey led to the quantification of important aspects of water supply and sanitation. It also outlined the priorities of the local inhabitants in terms of community development and led to a better understanding of their attitude towards the constructed wetland project. Although this survey gave some precise, quantified information about a wide range of topics, it explored none of these issues in depth. Due to their very structured nature, social surveys hardly offer the interviewees any time to carefully reflect on a question and the opportunity to express themselves with their own words.



- *Stakeholder analysis*

Stakeholder analysis can be defined as an approach for understanding a system by identifying the key actors or stakeholders in the system, and assessing their respective interest in that system (Grimble and Chan 1995). Like social surveys, stakeholder analyses make use of matrices. Stakeholder analyses focus on an event and on all the stakeholders involved. These analyses are ordinarily carried out during the preliminary stages of a project, in order to minimise the sources of conflict among the various stakeholders and to optimise their participation in the project framework. In June 1999, the wastewater treatment project in El Copal was still in the construction phase three years after its inception. No stakeholder analysis had been carried out as a preliminary stage. It was decided to undertake this analysis retrospectively to obtain a better insight into the failures of the project development. The analysis involved a series of topical interviews conducted in a structured manner. This technique helped to identify factors that affected the construction process and that could threaten the project sustainability. On the other hand, it was found that this data collection tool, involving structured interviews focused on a limited number of issues, did not promote the emergence of new concepts.

- *Informal conversations*

Numerous informal conversations were held with different stakeholders of the constructed wetland project (e.g. University of Guanajuato staff, community members) as well as external informants, such as two social scientists involved in other development projects in El Copal. Many concepts which were relevant to the study were gathered during these conversations, and would later be tested through more structured methods. However, it took some time to get acquainted with this qualitative research method. Very few of these talks were recorded, and only a few notes were taken. At the end of the pilot case study, it became evident, though, that informal conversation was one of the most relevant data collection techniques for the study, but that a reliable and consistent approach to recording would be needed.

- *Semi-structured interviews*

A series of semi-structured interviews was undertaken with three community members. They dealt with several topics, including population activities, participation, power

distribution, and the attitude of the community dwellers towards the constructed wetland project. The information gathered was valuable but the number of interviews was insufficient to develop a thorough insight into the situation. Semi-structured interviews were deemed relevant, although the number of topics should not exceed five to favour the free expression of the interviewee and the emergence of new issues.

• *Feedback*

Three informants were asked to give their feedback about two reports produced by the author, one presenting the results of the stakeholder analysis, and the other examining the evolution of the wastewater treatment project. This technique was used to reduce the observer bias. This feedback led to the correction of a few misunderstandings, but the results obtained were far below the expectations. This data collection technique appeared to be very difficult to implement. First, it required the reports to be translated from English to Spanish in a language accessible to informants from all the cultural arenas. Once chosen, the motivation of these people to read and comment on the reports within a limited amount of time was low. This technique was first tested in El Copal, and tried out again in Tepezalá, but it proved to be inappropriate. Furthermore, it appeared that reducing the observer bias was not an issue to tackle after the data collection phase, in a palliative way, but rather something to address directly in the methodology.

### 2.3. Selected Techniques

#### a) A set of data collection tools

The five-month pilot case study in El Copal led to the conclusion that qualitative research methods were fundamental for the in-depth exploration of sanitation development in Mexican communities, allowing for the complexity of the issue and the interactions of its components. Several other data collection techniques were selected although the control of the research subjectivity would ultimately depend on the rigorous and thorough application of qualitative interviewing techniques. This section reviews the methods used in Tepezalá, Morelos primary school in El Mirador, and San Luis Beltran. Each technique is introduced with examples of its use during the fieldwork.

b) Literature review

Literature review was an important tool for the baseline study of each case study, where a global knowledge of the community and its regional context was wanted. Cultural features characteristic of Mexico and that are relevant to the research were also obtained from the review of the literature. The acquisition of this general knowledge was a prerequisite to a holistic understanding of sanitation development in each case study.

• *The local context*

The literature review provided information about the community's natural environment (hydrology, geology, climate, land use, maps...), population demographics, dwelling characteristics, public infrastructure, economics, and history. The municipal statistical reports and maps published by INEGI (National Institute of Statistics, Geography and Computer Science) were systematically used to gather this type of information. Additionally, according to each case study, all sorts of literature describing the local environment were used, these were obtained from various sources such as research centres, local authorities' archives, local press, or public institutions.

• *The regional context*

Literature was also reviewed to obtain an outlook of the region surrounding the village studied. The objective was to find how the sites investigated were affected by their regional context. For example, the respective situations of San Luis Beltran and El Mirador could not be thoroughly understood if they were not examined in the context of their regional environment. The phenomena of immigration and urbanisation in the Central Valley region, as well as the sanitation and water supply systems of the metropolitan zone of Oaxaca City were investigated. A substantial amount of information related to these themes was gathered through literature review. In the Tepezalá case study, the hydrological context of Aguascalientes state was deemed relevant to sanitation development in the community. A large amount of documentation on this topic was found in the INEGI state reports and in research publications presented at the 2<sup>nd</sup> National Congress on Groundwater (held in November 1999 in Aguascalientes City).

• *The Mexican context*

At the end of the El Copal pilot case study, it appeared that widespread cultural features, such as corruption and machismo had a significant influence on sanitation development. It seemed necessary to learn about some aspects of Mexican culture, which have major implications on people's daily behaviour, and that characterise politics and the institutions. A number of anthropological and cultural and political studies were reviewed, which deal with Mexican culture in general, e.g. 'The Labyrinth of Solitude' (Paz 1985), or which tackle more specific topics, such as poverty in Mexico, as in 'Los hijos de Sanchez' (Lewis 1961), or the Mexican political environment of the nineties, as in 'Bordering on chaos' (Oppenheimer 1996).

c) Qualitative interviews

In each case study, most of the data collected were obtained through qualitative interviewing. This section presents the different forms of interviews that were used, and how they were recorded and transcribed. Practical issues related to the choice of the interviewee, interview setting, and extra information about interview recording and transcription, are discussed in Appendix 1.3.

• *Informal conversations*

Some interviews were undertaken as informal open-ended conversations, where one or two broad topics were introduced. In these unstructured, non-directive interviews, the conversation unfolds naturally according to the issues explored by the interviewee. These informal conversations involve asking questions, listening, expressing interest, and recording what was said (Neuman 1997). This technique encourages the interviewee to express freely his/her own perception of complex issues. This kind of interview was generally used at the beginning of each case study, to approach the water and sanitation issue as a whole, suspending personal assumptions.

For instance, at the beginning of the El Mirador case study, the nine staff members of the primary school were interviewed. The conversations dealt with the general lack of improvement in the school, notably regarding the sanitary conditions. A large number of issues emerged in this first series of interviews (see interview transcript in Appendix 2.1.). At the beginning of the San Luis Beltran case study, the ex-community leader was interviewed about the water issue in the community. He approached this complex topic

from different perspectives, introducing the community historical background and outlined some characteristics of the natural environment. More specific issues were discussed too, such as the ecological toilets program in the village and how the sewer system project was agreed. Informal conversations stimulated the emergence of concepts, which were examined in more detail using other methods, such as topical interviews and social surveys.

- *Topical interviews*

Topical interviews are semi-structured interviews focused on a particular event or process. The researcher is generally looking for detailed factual information and he plays a more active role in directing the questioning and in keeping the conversation on a specific topic (Rubin and Rubin 1995). This data collection technique was usually used after the first 'baseline study' phase of each case study, when a wide range of ideas had already been gathered and when in-depth understanding of some issue was wanted.

For instance, after a few weeks working in San Luis Beltran, precise information was wanted about how and why the sewer system project had been accepted by the community. Several community members were interviewed specifically to explore these issues. Some related themes were often tackled during these interviews, such as for instance, the problem of water scarcity, the granting of new water outlets, or the efficiency of ecological toilets. In the El Mirador case study, eight parents were interviewed, who either had children in Morelos primary school, or who had already taken them to another school. Several themes were discussed in detail during these topical interviews, including the quality of the teaching, the sanitary conditions at the school, the inefficiency of the parents' committee and their motivation to chose this school (see interview transcript in Appendix 2.2).

- *Cultural interviews*

Cultural interviews investigate the common values of a group of people, their typical activities, their beliefs and the world views they share. They require the researcher to listen attentively to the interviewees and to interrupt them as little as possible (Rubin and Rubin 1995). There is no fixed agenda of topics to tackle, and the atmosphere has to be relaxed. A few cultural interviews were planned at the beginning of the case studies

to learn about the history of the community, the evolution of people's activities, the changes in the village, or the evolution of water management and sanitary practises.

A 97-year-old man, ex-municipal agent of San Luis Beltran, was interviewed. He spoke about life in the community at the beginning of the century, farming and the harsh conditions of life. He shared his vision about the changes that marked this century: the revolution, the expansion of Oaxaca City, road construction, and the increasing water scarcity. He also remarked that open-air defecation used to be normal and explained how ecological toilets are very valuable for the farmers. This interview was an introduction to the culture shared by the older generations of the community and it raised interesting issues: the change in people's activities, the shift from a rural to a peri-urban community, the cultural gap between the generations, the increase in population density and the water scarcity (c.f. interview transcript in Appendix 2.3).

• *Recording and transcripts*

The data collected through qualitative interviewing were either partly memorised and recorded as field notes, or taped using a microcassette recorder. How the information was recorded depended on the context of the interview and on the interviewee. The interviews were transcribed in MS-Word file format and the interviewee's sentences were quoted as often as possible. A log section was inserted at the beginning of each transcript. This informs the reader about the context of the interview (date and time, setting, general feeling, personal comments) and specifies the part(s) of the interview that were deliberately left out.

d) *Social surveys*

Four social surveys were carried out during the three case studies. They are briefly outlined in Table 3.2, but a more detailed presentation is available in Appendices 2.4 to 2.7. They were primarily used to quantify some of the characteristics of the sanitation systems. Surveys gave approximate answers to questions such as: 'How many people use pit latrines or defecate in the open air?', 'How many people are satisfied with their ecological toilets?', 'How many use it properly?', or 'How many people consider the sewer system as an improvement?'. The social surveys were not designed to bring out significantly new concepts, but they allowed existing hypotheses to be dismissed or reinforced by testing them on a representative group of people.

Table 3.2. Social surveys: interviewees and topics for discussion

| Case study                         | Focus group                       | Main topics                                                                                                                                                              |
|------------------------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tepezalá                           | Farmers reusing the pond effluent | Wastewater reuse, farming practices, Water management, farmer co-operation, Improvement in the wastewater treatment system                                               |
|                                    | Community sub-group: Cholula II   | Water supply and sanitation conditions, system inertia Priorities, concern for off-site system Stakeholder group organisation and leadership,                            |
| Morelos primary school, El Mirador | Pupils                            | School evaluation, pupils' priorities in terms of improvements of the school infrastructure Evaluation of school and home sanitary conditions                            |
| San Luis Beltran                   | Community                         | Influence of the urban zone Water supply and sanitation conditions Water scarcity and sewer system project Ecological toilets evaluation, toilet types and social status |

The surveys carried out in Tepezalá used a long questionnaire. Although valuable information was obtained it proved far too rigid (see survey questionnaire in Appendix 2.4). The results suggested that a more versatile use of social surveys was required and possible, since the statistical validity of the results was not an imperative issue. The three following surveys were thus designed to be more flexible and adaptable to each interviewee. The objective was to combine the advantages of a typical social survey, used to collect discrete information, with the features of topical interviews, that allow the interviewees to express their ideas using their own words. These surveys incorporated several sections. The first ones consisted of survey-like questions that could be answered in a few words only, while the next sections tackled issues that required more attention. The questions were grouped by topics but there was no strict order to follow. The free expression of the interviewee was encouraged, and often answers to the questions came up naturally in the flow of the conversation (see Appendices 2.5. and 2.7). Practical aspects of the social surveys (setting, population sampling) are described in Appendix 1.4.

#### e) Accounts of events

Some events were witnessed, which were meaningful for the research. Field notes were occasionally taken on these occasions, and were later transcribed like interviews. In Morelos primary school, El Mirador case study, field notes were taken during an assembly of the pupils' parents. The director, the teachers, the parents committee and 56 parents met during an afternoon to deal with several issues. This event was interesting, as the degree of participation of the parents could be observed and some important

issues were raised (c.f. Appendix 2.8.). Similarly, some observations were recorded during a community assembly, where the lack of participation and the internal division in the community were manifest.

f) Photography

Data collection was not restricted to written or oral material. Pictures were taken to describe the natural environment of each case study, the habitat types, domestic sanitation facilities and community wastewater treatment infrastructure. Some pictures taken in the neighbourhood of El Mirador depict the phenomenon of chaotic peri-urban development due to massive rural exodus. In Tepezalá, a series of snapshots illustrate several aspects of the centralised sanitation system, while other photos show the marginal living conditions of the people of Cholula II, the northern part of the village. Photography was a valuable data collection technique.

g) Measuring methods

Flow-metering methods were used to estimate the sewer system discharge, the river discharge, and the water supply flow. Though the techniques used were rudimentary (i.e. bucket-chronometer method, float/section area method) and the periods of data collection short, they provided an approximate quantification of some technical aspects of the sanitation infrastructure. In the Tepezalá case study, for instance, it was important to estimate the sewer discharge in order to derive the retention time of the pond, its potential pathogen removal rate, and to evaluate the sanitary risks associated with crop irrigation with the 'treated' effluent. In the San Luis Beltran case study, water scarcity was considered as a major issue in the choice of an appropriate sanitation system. The amount of water brought to the village through the gravity water supply system had never been quantified. Though the significant seasonal variations could not be measured, some measurements were made and the daily volume of water potentially available per capita in the community was calculated.

## 2.4. Reliability of the data collection process

a) Reliability in qualitative research

The previous section described the set of methods that was used to gather information about sanitation development in the three case studies. Although the relevance of these tools in the context of this research was justified and examples of their use on site were



given, the reliability of the methodology has not been discussed so far. In qualitative research, most indicators of validity and reliability are inadequate, as reliability mainly depends on the researcher's insight, awareness, suspicions, and questions (Neuman 1997). However, according to Rubin and Rubin (1995) the credibility of the work can be assessed through its consistency-coherence, communicability, and transparency.

A study is credible if the information on which it is based is consistent. Some inconsistencies can occur between case studies, between several sources of information of a same case study, and even between the statements of a same individual. The results must show that the researcher has identified and examined these sources of incoherence. Communicability measures the capacity of the study to make the readers feel the reality of all the data collected. Deep descriptions, vivid interview transcripts, abundance of details and evidence make the work communicable. While both the consistency and the communicability of the work are evaluated through the analysis and the discussion of the results, the transparency of the research depends mainly on the methodology

#### b) Transparency

In qualitative research, the influence of the researcher on the outcome of the experiment is notable. The observer is part of the experiment and interacts with the subject of the study. The information the interviewee provides is influenced by the kind of relationship that is developed with the interviewer. Unlike in natural sciences, qualitative methods of investigation do not pretend to obtain objective results, which can be validated by anyone following the same methodology. What is required, though, is to bring transparency into the research. The reader must be able to follow in detail all the steps of the data collection process. The reader must have access to the information gathered during the investigation and to the circumstances in which the information was obtained.

#### • *Case study synthesis reports*

At the end of each case study, several reports were written, which organised and synthesised the large amount of data collected. They are available for examination on the CD-ROM attached to this study. Through these reports, the reader can follow the process of the fieldwork and get closer to the original source of information, without getting lost in the tedious examination of all the interviews and survey results. A

methodology section introduces these reports and justifies the use of particular techniques for given purposes. With the exception of the farmers' survey in the Tepezalá case study, the methodology and results of each survey are presented in a separate report (also available on the CD-ROM), that mentions the difficulties met and discusses the relevance of the technique.

- *Transcripts log sections*

The systematic insertion of a log section at the start of the interview transcripts brought transparency into the data collection process. The log describes how the original information was recorded (directly from tape, from field notes and/or from memory), it gives information about the interview setting (i.e. where, when, the presence of other people) and defines the general atmosphere of the conversation (e.g. 'relaxed atmosphere', 'the interviewee was short of time'...). In addition, the log sometimes includes extra comments, such as: 'the interviewee seemed anxious when I mentioned the name of so and so...' What is left out of the original recording (due to confidential reasons or lack of relevance) is also noted in the log.

- *Core information availability*

All the interviews were transcribed and the transcripts can be consulted on the attached CD-ROM. The original field notes (of interviews, events, and surveys, or personal notes taken at home) and the tape recordings can be made available on request. The calculation made to estimate the flow of the river Grande and the flow in the gravity water supply system of San Luis Beltran can be checked on MS-Excel spreadsheets (c.f. CD-ROM). Thus, it is possible to return to the source of any piece of information, and to know in which circumstances it was obtained.

### **3. Representing the sanitation development issue**

#### **3.1. Data analysis and presentation of the results**

As the fieldwork was completed, the second phase of the research began, involving the analysis of the information gathered in the three case studies, and the presentation of the results using conceptual maps. Data coding, the systematic organisation of the collected information, was the first stage of data analysis. This process is described in Section 3.2. The following section explains how the individual components of the sanitation system, as well as their mutual relationships, were isolated. Finally, Section 3.4 introduces conceptual mapping, the technique that was used to present the factors affecting sanitation development as a network.

#### **3.2. Data coding**

##### **a) Analysing the raw data**

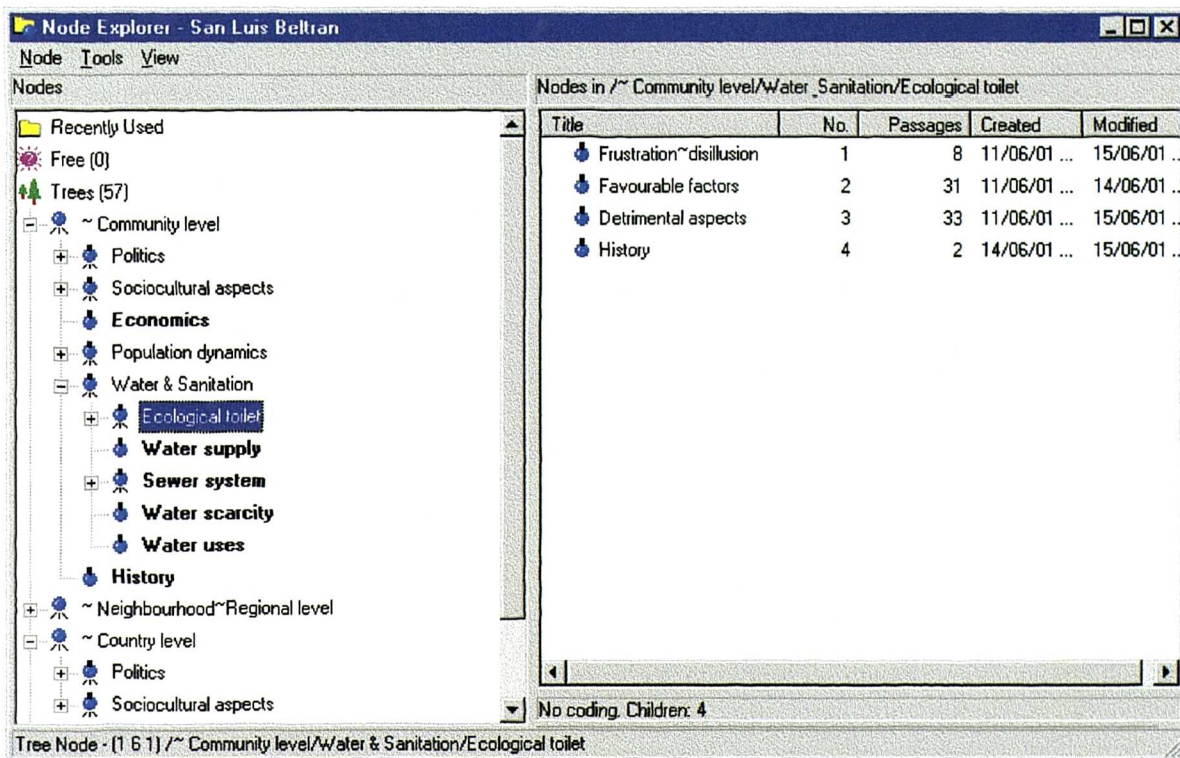
Data coding involves grouping the raw data (interviewees' response, literature, survey results) into categories that bring together similar ideas, concepts and themes discovered during the fieldwork. This stage is an essential part of the analytical process in qualitative research. 'It frees the researcher from the entanglement in the details of the raw data and encourages higher level thinking about them' (Neuman 1997). The process of coding is guided by the research question: in the case of this study the aim is to improve the understanding of sanitation development. As a consequence, the coding of the information was oriented to the identification of factors influencing the development of sanitation in each case study.

##### **b) Tools and procedure**

QSR Nvivo (Version 1.2.142) (QSR International 1999) is a recent computer application software developed to support the work of qualitative researchers, notably with regard to data coding. It considerably facilitated this laborious task, while promoting rigour and transparency in the process. The three case studies were treated separately. All the relevant information collected during the fieldwork in Mexico –interviews, survey reports, field notes, case study synthesis reports, but with the exception of photographs– were imported into the computer software and coded.

The information of each case study was coded into a large number of categories (called *nodes* in QSR Nvivo) organised in a hierarchical structure (referred to as *tree* in the programme). Figure 3.1. is a 'screen captured' image of the node tree corresponding to the San Luis Beltran case study.

Figure 3.1. Node tree of the San Luis Beltran case study



The structure of the tree was the same for all the case studies. It consists first of three main branches (nodes), namely *Community level*, *Neighbourhood-Regional level*, and *Country level* (the tree of El Mirador case study has a fourth branch: *School level*). This is the first degree of classification used to distinguish between the origin of the factors influencing sanitation development. For instance, if the interview of a community dweller referred to the effects of a state sanitation program on the domestic sanitary conditions, this section would be coded in the *Neighbourhood-Regional level* node.

A next degree of classification, with several nodes, involves numerous disciplines (e.g. economic, political, technical, socio-cultural, institutional). The information is coded according to the type of discipline(s) that would typically be used to analyse it. This form of classification corresponds to the way people in the West have been trained to organise their knowledge. Thus, for instance, data referring to the financial limitations

of the municipality (and its effects on the provision of public water supply and sanitation services) was coded in the *Neighbourhood-Regional level\economics* node. Branches of the tree that have no sub-branches are the tree fruit: they are the nodes filled with specific information. For instance, the reasons that explain why the ecological toilet technology is not so popular among community members, were stored in *Community level\Water and Sanitation\Ecological toilet\Detrimental aspects* (see *Figure 3.1.*).

#### c) Data Coding: a fragmenting process?

The principal function of the tree is to group the information in small, analysable, data sets. A two-level classification was used, with the primary criteria based on scale (*Community level, Neighbourhood-Regional level, and Country level*) and the secondary criteria based on disciplines. This reduces the number of main branches and so brings some clarity to sorting the factors influencing sanitation development. However, building node trees and classifying information into such hierarchical frameworks can be regarded as a typical fragmentation process. The use of distinct disciplines to classify the data can be seen as a typical example of knowledge fragmentation. Fragmentation is indeed inherent in the organisation and the analysis of the information collected through the case studies.

However, an important feature of the *QSR NVivo* program is that it allows the same piece of information to be coded at different nodes. Consequently, an idea contained in one section of an interview can be coded at several locations of the tree. The nodes are distinct entities but they are not independent categories, and there are implicit links among the branches. Being critical about the analytical process undertaken in this study was fundamental. Indeed, this investigation was undertaken under the working hypothesis that sustainable sanitation development requires a holistic approach. The fragmentary nature of the analytical phase was acknowledged, but the awareness of this aspect led to the maintenance of implicit links between pieces of information by coding them at several nodes.

### 3.3. Node summaries

The content of each node was reviewed in detail, and the various ideas were analysed and compared with each other. For each case study, the most relevant ideas of each

node were compiled in three separate text files (including local, regional and national aspects respectively). These ‘node summaries’ comprise short sentences describing direct or indirect influences on sanitation development. Rather than being vivid and comprehensive descriptions, these statements are short and are essentially meant to highlight causal relationships between two or more concepts. Some examples are given below:

*Social cohesion hinders corruption, promotes the participation of people to community development.*

*Two years have passed since the sewer system was built and it is not operational yet. Many community members do not want to pay until the sewer is operational. Unwillingness to pay hinders the sewer system defects from being fixed.*

*People first accepted the ecological toilets because they believed that they would never get access to a sewer system, because it was too expensive and the community leaders disapproved the use of this technology.*

*Paternalism leads the people to accept everything the authorities offer them, without knowing the use they'll make of it. As a consequence, the ecological toilets were widely accepted, but some people use them as a storehouse or a hen-house, and some just used the material to build something else.*

### 3.4. Conceptual mapping

#### a) Sanitation development as a system

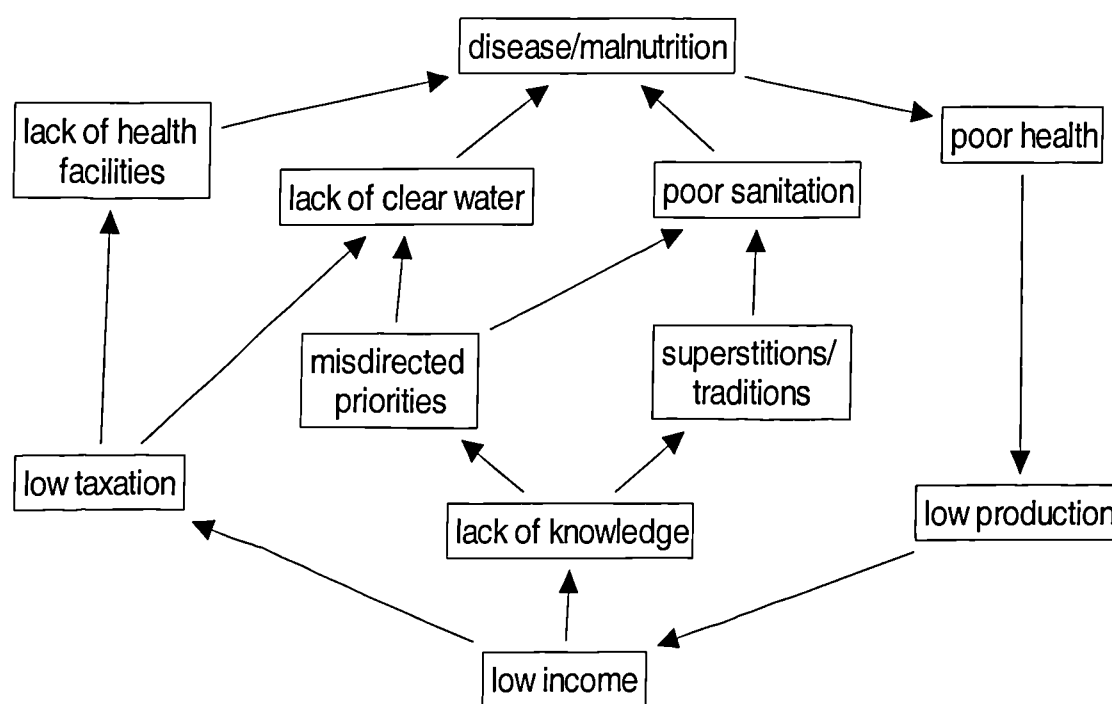
The first part of the methodology provided the means to investigate sanitation development in a holistic way. The process of data coding focused on the identification of the factors influencing sanitation development (the components of the system) and their mutual relationships. The result of these stages consists, for each case study, of ‘node summaries’, a collection of concepts, usually organised in pairs, and connected by a causal link. The review of this information reveals the diversity of the factors affecting sanitation development and suggests the existence of a web of relationships among these influences. The node summaries provide a deep insight into the factors affecting sanitation development, but these lists of short statements cannot show clearly the web of relationships. Conceptual mapping was the method selected to bring out a holistic

representation of sanitation development, emphasising the relationships between the system components.

#### b) Why conceptual mapping?

The approach followed to identify the various components of the system was mainly qualitative, and consequently the relative significance of the components and their relationships were not quantified. Conceptual mapping is appropriate to represent systems. The association of qualitative research methods allowing for multidisciplinary investigations with the versatility of the conceptual maps seemed a suitable combination for this research. Conceptual maps have already been used in a wide range of situations to represent complex issues and the interactions among their components. Two examples of conceptual mapping are presented below. Figure 3.2. is a small conceptual map developed by Burkey in 1993, which depicts the web of factors keeping people in illness and poverty. Figure 3.3. is a more complex map designed by a French agency in charge of the management of two river basins. The map highlights the interactions between the different water uses at catchment level.

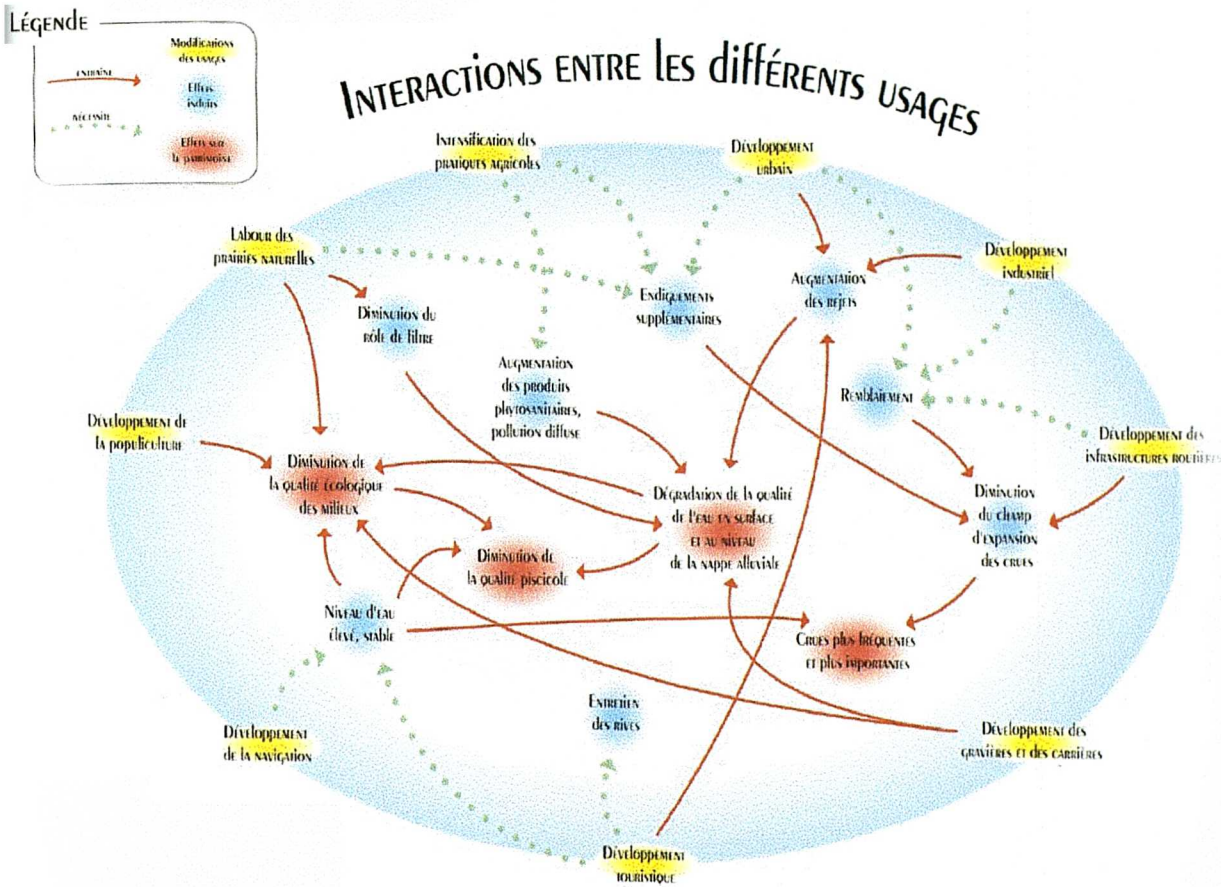
Figure 3.2. A Vicious cycle of poverty and disease



(Burkey 1993)



Figure 3.3. Interactions between water uses



(Syndicat Mixte Saone et Doubs 1998)

### c) Building the conceptual maps

Conceptual maps basically consist of concepts related by links that usually, but not necessarily, correspond to causal relationships. The maps created in this study are therefore made of small units consisting of a cause concept and an effect concept related by a positive or negative cause-effect relationship. Three maps were made: one for each case study. The concepts of the maps correspond to factors that were found to play a major role in sanitation development. They were selected in the node summaries. This selection process was undertaken on the basis of two criteria:

- The map had to show the complexity of the situation in a comprehensive way while remaining accessible in terms of size.



- The map had to highlight the uniqueness of each case study. In other words, regional and national factors should not mask local factors, though their overall significance might be greater.

This choice to highlight the specificity of each case study was motivated by the idea that by presenting the complex dynamics of sanitation development at local and regional level, there are more opportunities to improve the situation. Local strategies that take into account the characteristics of the site are often easier to implement than large-scale measures and they can provide significant results, even though they might address less important factors. Strategies that make the most of the strengths of a community, such as its efficient water committee or its strong mutual help tradition, are likely to be successful.

In the conceptual maps made in this study, the concepts are presented as concept-boxes. A colour code was used to characterise these components of the maps. Each of the five colours corresponds to a perspective from which a concept would typically be approached in Western culture. For instance, a concept-box that describes a feature of the political organisation was assigned the colour grey. This colour code was used assuming that the maps would reveal the interconnectedness of issues traditionally addressed separately through distinct disciplines. The computer software Banxia Decision Explorer (version 3.1.2. Student) (Banxia 2000) was useful to arrange the different concept-boxes of the map minimising concept-link criss-crossing.

More details about the actual form of the conceptual maps and advice about how to read them are given in the first section of the next chapter.

## **4. Conclusion**

This chapter provided a detailed description of the methodology developed for the holistic assessment of sanitation development in Mexican villages. The scope of the research and the criteria for the case studies selection were defined. Attention was drawn to the essential influence of the pilot case study on the comprehension of the research arena and on the choice of data collection techniques. Particular emphasis was put on the data collection process. A versatile set of techniques was selected to identify all the components of the sanitation development system and their relationships. Several

principles guided the data collection process, allowing a deeper insight into some parts of the system without losing awareness of the whole picture. The data analysis, notably through coding, was undertaken in a way that gave priority to the interactions between the factors influencing sanitation development. The conceptual maps were chosen to represent graphically this understanding of sanitation development from a holistic perspective.

## Chapter 4 - Results

### A. Introduction

#### 1. Preamble

The results compiled in this chapter are organised in three independent sections (Section B, C, and D) which refer to the work undertaken in El Mirador, San Luis Beltran and Tepezalá. Each of these sections presents and describes in detail the conceptual map of the sanitation development system of *each case study*. *Section A* provides the reader with useful advice on how to read the conceptual maps and make the most of this chapter.

Considering the length of this chapter, the relevance of incorporating the three case studies in the result chapter has been debated. On reflection, the *option consisting in* condemning some of the case studies to the Appendices was rejected. All the case studies deserve to be included in this chapter since they are equally significant with regard to the research process. Furthermore, presenting all the results permits discussion of the similarities between the case studies (c.f. Chapter 5) and helps to demonstrate the robustness of the approach in varying circumstances. Nonetheless, the process of reading thoroughly all the results, one case study after the other, might be tedious and tiresome. Since this research is primarily concerned with *developing an approach* to sanitation development, and as the three case studies were undertaken with the same approach, it is suggested that only one case study needs to be read entirely. The number and the choice of case studies to be read is of course at the reader's discretion. Section B and C are nonetheless likely to be more appealing to the reader than Section D, which corresponds to the case study undertaken first during the fieldwork, that is to say, before the methodology had reached its full maturity. Short introductions and conclusions briefly present the characteristics of each case study and the sum up the main findings. By reading them, the reader can decide to skip one or two case studies without missing the information required to fully understand Chapter 5.

## 2. How to read the conceptual maps

A conceptual map consists of concepts related by concept-links. In this study, the concepts are presented as concept-boxes, and are regarded as factors that directly or indirectly affect sanitation. The relationships are causal, as suggested by the arrow shape of the links. The conceptual maps used in this study are therefore made of small units consisting of a *cause concept* and an *effect concept* related by a positive or negative *cause-effect relationship*.

Figure 4.1. Conceptual map unit

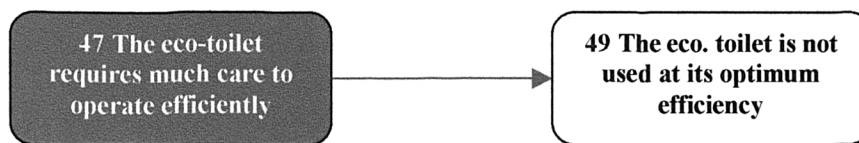
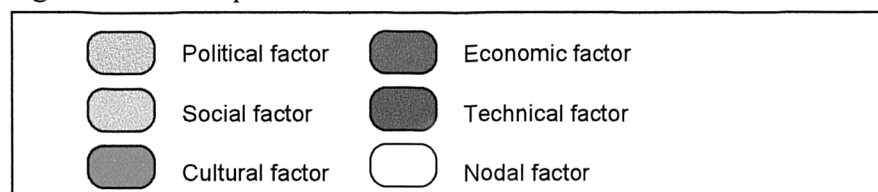


Figure 4.1. shows two concepts related by a positive causal relationship. The number preceding each concept is used for identification purpose. A positive causal relationship between two concepts A and B can mean 'A *leads to* B', 'A *promotes* B', 'A *favours* B'...and a negative causal relationship between A and B can be translated by 'A *prevents* B', 'A *impedes* B', 'A *hinders* B'... In the example given in Figure 4.1., the fact that the ecological toilet requires much care to operate efficiently favours its inefficient use by the population. If A is indirectly related to B, that is, if A and B are distant links of a concepts chain, then the *indirect effect* of A on B can be calculated. It is negative if the path owns an odd number of negative arrows. In any other case, it is positive. However, in the maps described in this study, the causal relationships are mainly positive.

Figure 4.2. Concept colour code



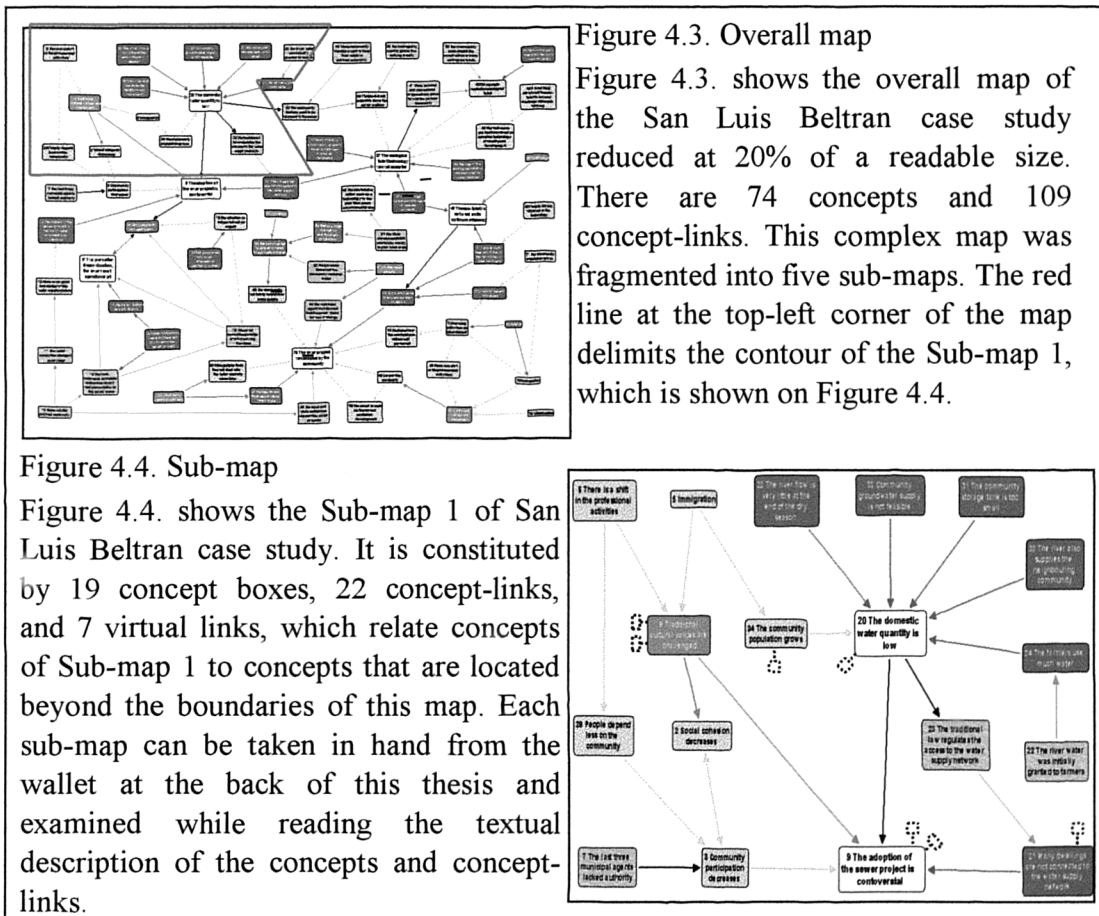
A colour code is used to characterise the concepts-factors affecting sanitation. Each colour corresponds to a perspective from which that factor would typically be approached in the Western culture. A concept can be viewed from a social, cultural, political, technical, economical point of view. On Figure 4.1, the concept 47 is

coloured in green, which means that this factor would commonly be analysed as a technical issue. Nodal Factors (white concept-boxes) are the leading concepts of the map. Figure 4.2 presents the colour code, which appears on the legends of the maps.

### 3. Overall maps, sub-maps, connection groups

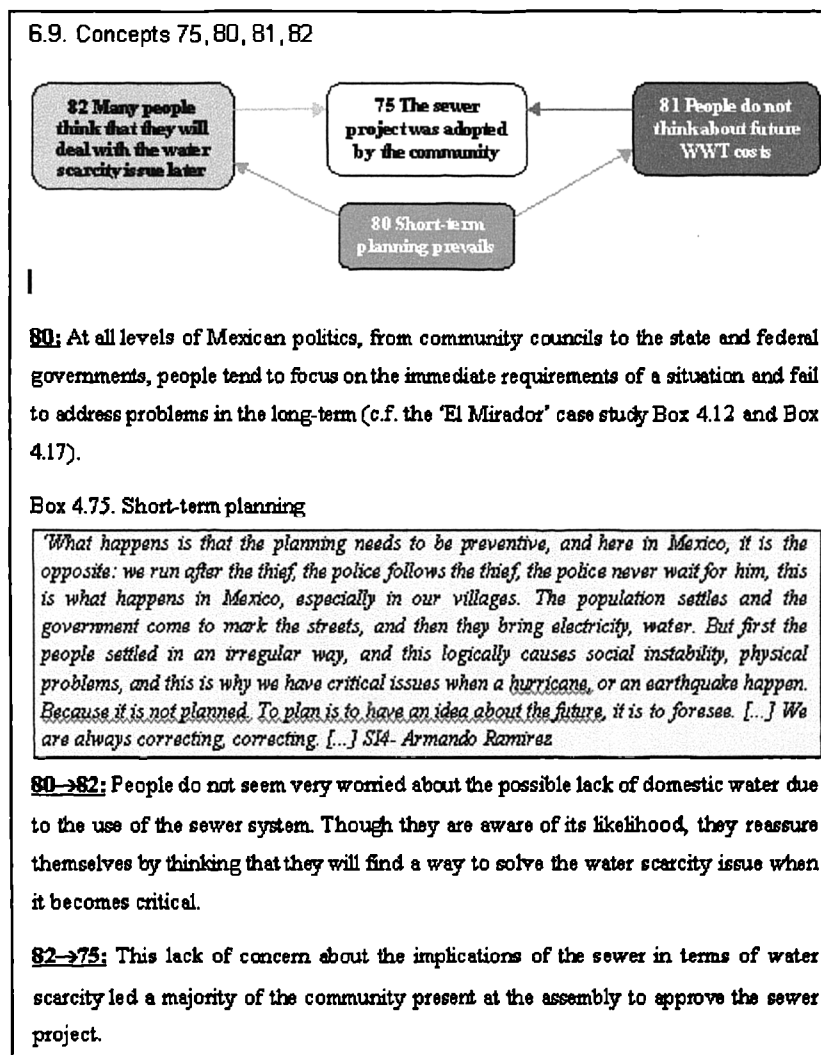
Each case study is introduced by an *overall conceptual map* describing its sanitation system. The main purpose of these dense graphical representations (60-70 concepts) is to demonstrate the complexity of the sanitation issue and the interconnectedness of the factors affecting it. For practical reasons these three overall conceptual maps are not analysed as such. To make them more appropriate for reading and analysis each overall map is fragmented into several *sub-maps* comprising 15 to 20 concepts. There are four or five sub-maps per case study. They overlap each other slightly so that no concept and concept-link are left out in this fragmentation process (see Box 4.1.).

#### Box 4.1. Overall map and sub-map



Each sub-map is divided in smaller sets of concepts (3-6) called *connection groups*. Their sum encompasses all the concepts and concept-links of the sub-map. Figure 4.5. is a snapshot of the description of the San Luis Beltran case study, sub-map 5. In this example, the connection group consists of four concepts and four causal relationships. All the components of the connection group are concisely defined. Grey boxes including interview quotes, pictures or tables usually supplement the information provided by these definitions. These grey boxes present a small part of the raw data collected on site. They make the results more vivid and the study more communicable. Each quote is introduced by the initial letters of the person quoted. 'J' (Jacques-Edouard Tiberghien) and 'Q' (survey question) refer to the author. Each statement or interview quote is assigned a code that allows the reader to consult the entire report or interview transcript on the attached CD-ROM.

Figure 4.5. Connection group, textual descriptions and box



## B. Morelos primary school, the El Mirador case study

### **1. Introduction**

The results presented in this section are the outcome of the investigation undertaken in Morelos primary school between May 2000 and September 2000.

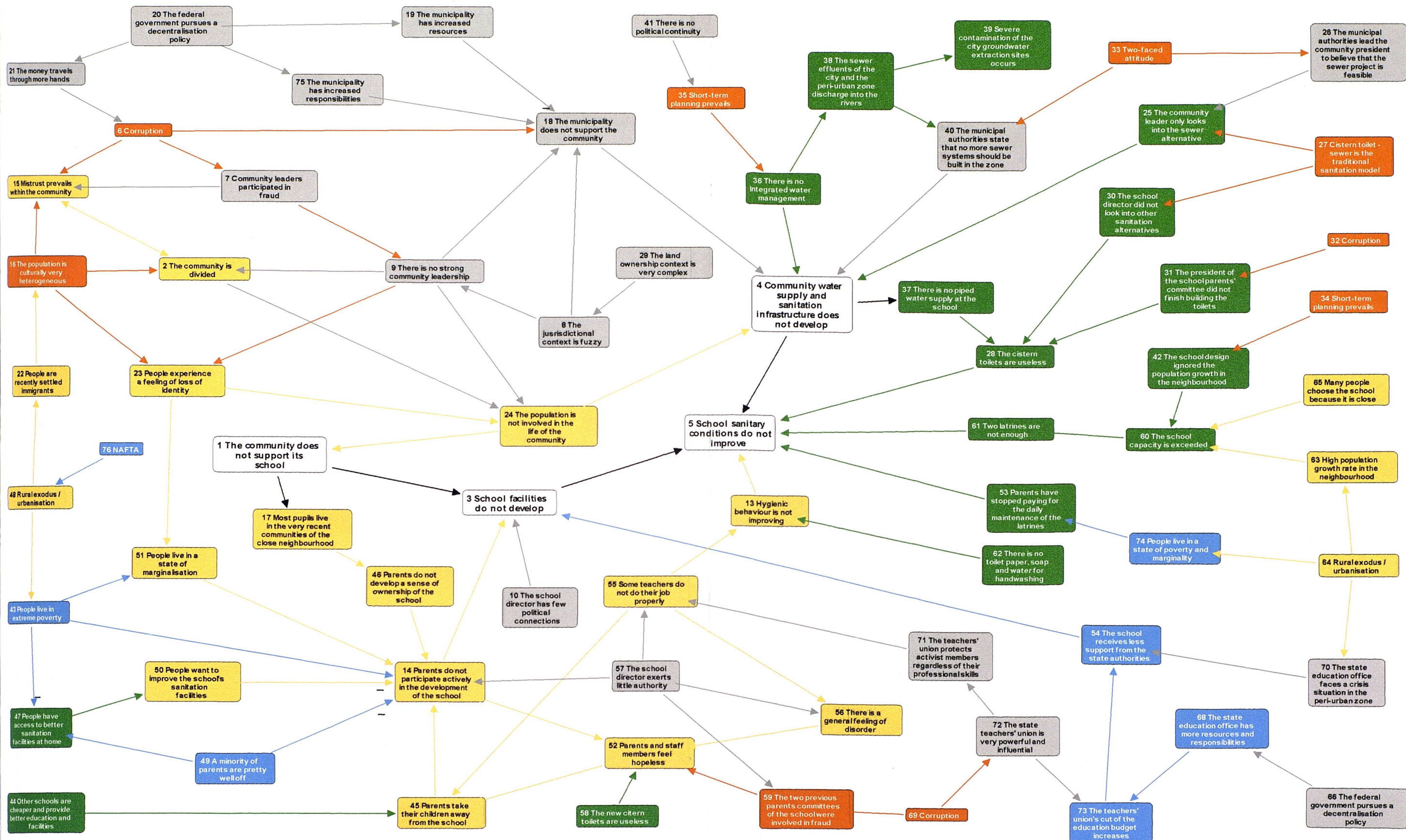
El Mirador is a community of about 1000 inhabitants that mushroomed during the early 80s in the peri-urban zone of Oaxaca City, Oaxaca state, South Mexico, in a context of rural exodus and rapid urbanisation. Poverty, cultural heterogeneity, harsh social fabric, and weak leadership are features that depict the community background.

There is no community water supply network. Most people rely on private wells dug in their backyards. The dwellings located in the bottom part of the village are connected to a sewer system. People without access to the sewer system mainly use pit latrines, though open-air defecation alongside the river nearby is common.

When the Morelos primary school was built in 1990, it was designed to receive up to 60 pupils. A decade later, more than 200 children attend the school, but the general infrastructure has not developed accordingly. The sanitation facilities, notably, have not improved since 1990. The school has no access to the sewer system. Only two pit latrines are in use, and toilet paper is not provided. A woman used to be paid to clean the latrines but the pupils now carry out this duty.

In 1999, the school staff and the parents' committee attempted to upgrade the sanitation facilities. Six cistern-toilets were built, but the work was never finished and the toilets are useless because there is no water supply to flush them. There is no water and soap for handwashing.





# **'Morelos' primary school** **The El Mirador case study** **Overall map**

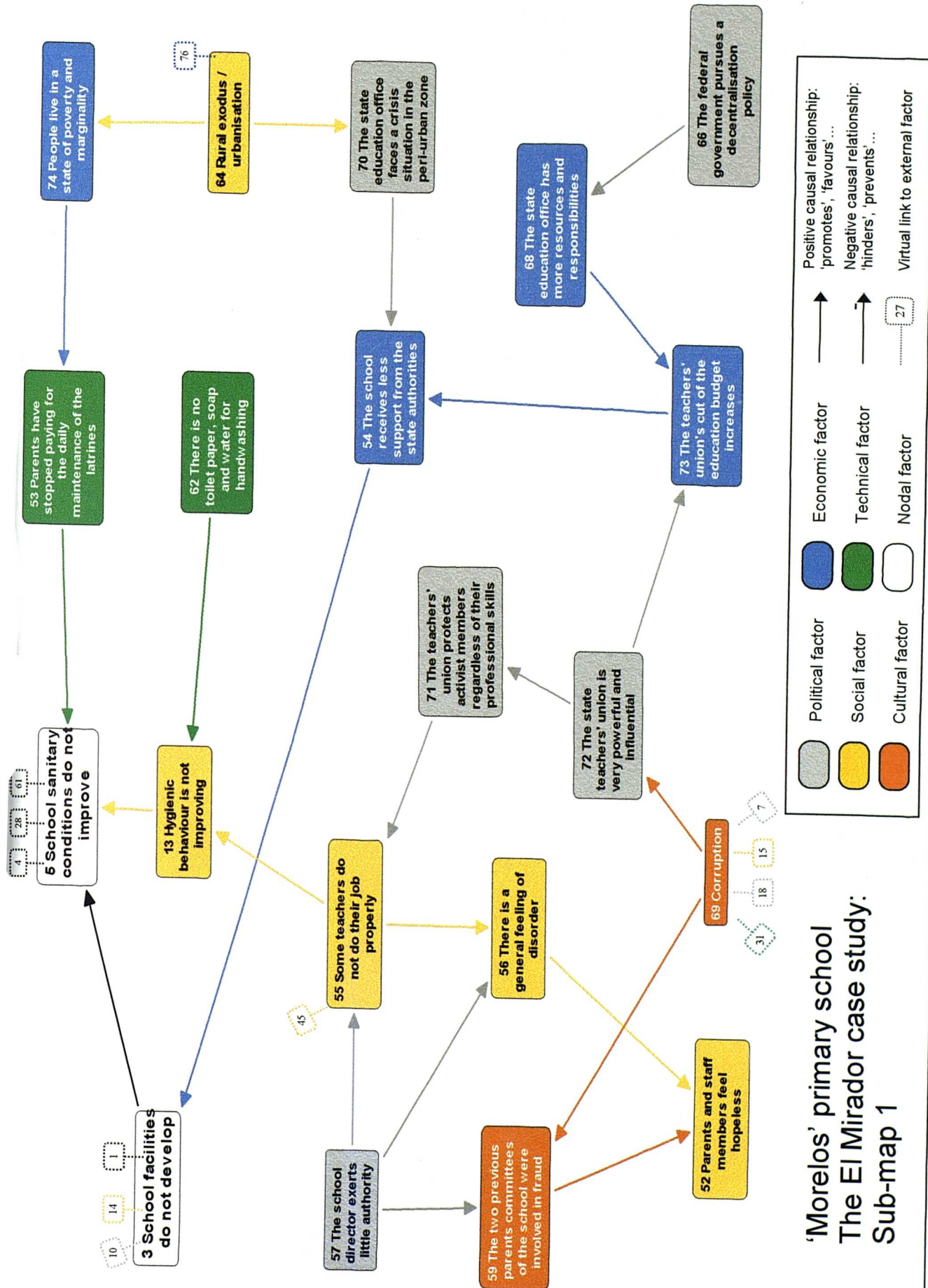


Political factor  
 Social factor  
 Cultural factor

Economic factor  
 Technical factor  
 Nodal factor

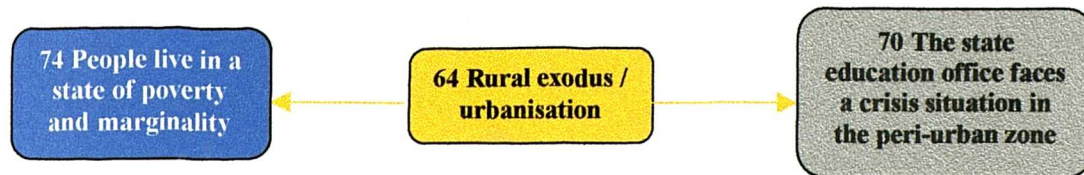
Positive causal relationship:  
 'promotes', 'favours'...  
 Negative causal relationship:  
 'hinders', 'prevents'...





## 2. Sub-map 1

### 2.1. Concepts 64, 74, 70



**64:** The 80s and the 90s were characterised by a high level of urbanisation in Oaxaca. This was particularly strong to the south of Oaxaca City, where El Mirador community is located, with an annual population growth rate peaking at 12.3% during the 80s (INEGI 1997). This explosive population growth resulted from the economic disaster of the agricultural sector and the consequent emigration of the people from the rural zones to urban zone (Velasco Rodriguez and Aguilar Sanchez 1999).

**64→74:** This migrating population moved to Oaxaca city for economic reasons. Consequently, in most cases, by purchasing a small patch of land with the only money they had left or through exorbitant interest mortgage rate, the families would find themselves in an even greater state of poverty. Their social life would be greatly affected as well. Uprooted, they would find themselves surrounded by immigrants speaking different languages and sharing different habits.

**74:** Most of the families which send their children to Morelos school are in acute financial difficulty and live in a hostile social environment.

**64→70:** Considerable investments were made by IEEPO (Oaxaca State Institute for Public Education) in recent years to build schools in the most remote places of the state. Many of these villages are now deserted by the young generations, leaving their schools half-emptied. The people that migrated to the metropolitan zone now require new schools, and the IEEPO cannot cope with this huge unforeseen demand.

#### Box 4.2. Poverty and marginality

*'They send them [to school] without dressing them, without washing them, without [even a tea in the stomach]...Many are very irresponsible with their children' MI24- Maxima Morales (pupil's parent)*



*'The kids are orphans, with ill fathers... most of them are in this situation, abandoned, their fathers in jail [...] I talked with their mums to persuade them not to abandon their children [...], they leave them to their grandmothers'. She mentioned that some children seem not to be hearing anything during the classes, looking traumatised, some have got 'bugs in their hairs', 'they do not eat before they come at school'. MI27– Marguarita (teacher)*

*'They lack resources [...] there are fathers with many children who haven't got a job, there are single mothers who work but earning very little' MI29 – Isabel (teacher)*

**70:** The IEEPO faces a critical situation in the peri-urban zone of Oaxaca city. The state education office is unable to meet the requirements of the population in terms of schools and teachers.

## 2.2. Concepts 74, 53, 5

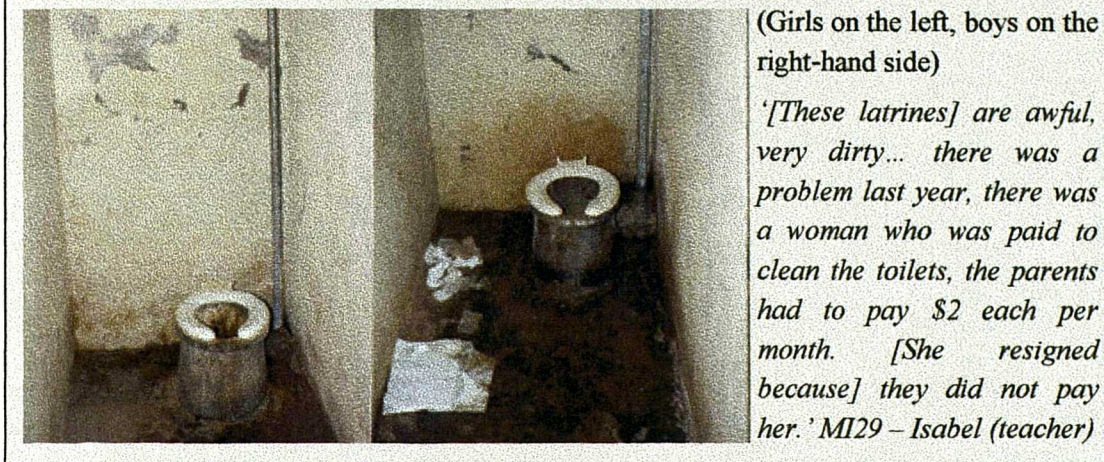
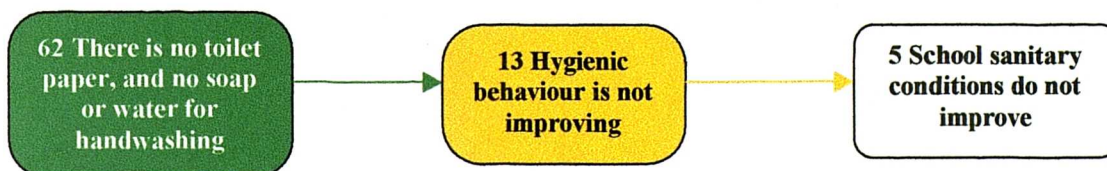


**74:** c.f. section 2.1

**74→53:** As a consequence of the high level of poverty and marginalisation in El Mirador and the neighbourhood, many parents have stopped contributing to the salary of the employee who cleaned the latrines.

**53→5:** Since the person who cleaned the latrines hardly ever got paid, she resigned and the pupils are now in charge of the maintenance of the facilities. They do not have the tools and products needed to disinfect and clean the latrines properly. The service is undertaken on a rota by all the pupil groups, with differing degrees of success. Failure to maintain a minimum level of maintenance in the latrines affects the sanitary conditions at school. Urine and used toilet paper cover the floor. Unpleasant odours make it hard for the pupils to concentrate.

**5:** The sanitary conditions at school do not improve: the water and sanitation facilities were not upgraded, and there has been no improvement in the way they are maintained and used.

**Box 4.3. Latrine maintenance**
**Figure 4.6. The pit latrines**

**2.3. Concepts 62, 13, 5**


**62→13:** The school does not provide any toilet paper for the pupils. There is no water supply or soap for hand washing. The pupils cannot follow basic hygiene practices at school. They may bring their own toilet paper but there is no soap or water to wash their hands.

**Box 4.4. Toilet paper**

*'The pupils buy their toilet paper, but mainly those of 1st to 3rd grade. The others use whatever kind of paper (notebook pages...). The youngest are more used to it [to using toilet paper at school] and they receive more attention from their parents and from the teachers.'* MI34 – Benjamin (School director)

**13:** The school does not provide the hardware (sanitation facilities, water supply, soap and toilet paper) and the software (cleaning staff, hygiene education) required for the pupils to develop hygienic behaviours.

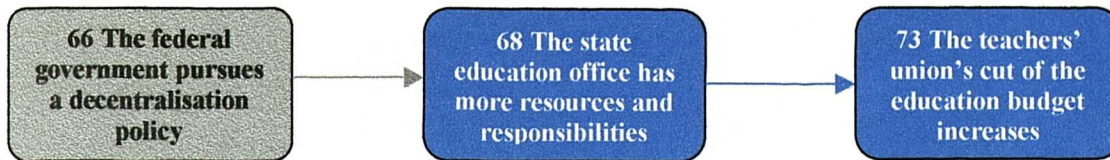
**13→5:** Poor hygiene affects the general sanitary state in the school. For example, during the breaks the pupils commonly share their food (crisps or sweets mainly). Lack



of toilet paper, and soap or water for handwashing are likely to lead to food contamination through hand contact.

5: c.f. section 2.2.

#### 2.4. Concepts 66, 68, 73



**66:** Notwithstanding its federal system of government, Mexico is considered as one of the most centralised countries of Latin America. A process of decentralisation was initiated in the 80s, and has been pursued by the federal government during the last two decades.

**66→68:** Decentralisation of the public education has been one of the meaningful feature of this lengthy process. Through the Secretariat of Education of Oaxaca, the state government is now responsible for managing education.

**68→73:** The state government of Oaxaca has received more resources to manage the public education sector. The teachers' union of Oaxaca state, which is politically very powerful and influential, has benefited from the decentralisation of the education by obtaining more resources from the state authorities.

**73:** The teachers' union of Oaxaca state takes a substantial amount of the resources in tially destined for the schools. This money benefits the teachers and the development of the organisation.

#### Box 4.5. The teachers' union of Oaxaca state

*'The Institute of Public Education of the State of Oaxaca was established in May 1992, as part of the national agreement for the modernisation of education through the decentralisation. [...] It is intended to devolve the administration and the resources of the Secretary of Public Education to the states. But in states like Oaxaca, to enjoy this godsend, the teachers' union put forward demands [...] and the authority accepted them and signed agreements... Thus today they complain, which is not entirely true, that all the money from its [the state education secretary's] budget is directed and channelled to pay salaries, and special bonus, and and other rewards to the staff for the teacher's celebration day, for the [...] end of the year, in December... And they claim that they don't have any more money.'*  
 Document M11 – Educational zone supervisor

## 2.5. Concepts 70, 54, 73, 3



**73:** c.f. section 2.4.

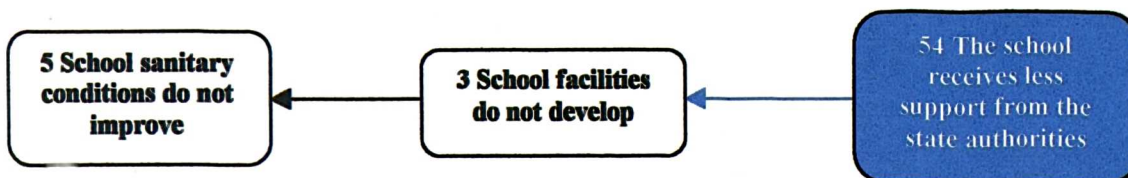
**70:** c.f. section 2.1.

**70→54:** In the regional context of rapid urbanisation, many communities have mushroomed during the 80s and 90s. Many of them now demand the support of the state authorities to improve their school. The Morelos primary school is just one of many recent schools, to which the limited resources of the state are distributed. Besides, some schools, which are in even more precarious condition are treated as a priority by the state education office.

**73→54:** As the teachers' union receives more funds from the state authorities, less of the money destined to education actually reaches the schools and has an impact on the pupils.

**54:** The school receives less support from the state authorities than before the decentralisation of the education sector.

## 2.6. Concepts 54, 3, 5



**54:** c.f. section 2.4.    **5:** c.f. section 2.2.

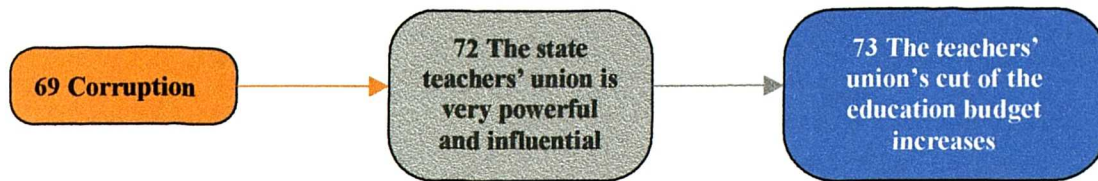
**54→3:** Morelos primary school receives less support from the state authorities, which hinders the improvement of the school facilities.

**3:** The school facilities (classrooms, furniture, educational equipment) have not improved, nor the water supply and sanitation facilities.

**3→5:** The lack of development of the school's general infrastructure (including sanitation facilities) prevents the enhancement of sanitary conditions.



## 2.7. Concepts 69, 72, 71, 73



**69:** Corruption is an important feature of the Mexican culture. It pervades most of the institutions and all levels of society.

**69→72:** The teachers' union of Oaxaca state has become one of the biggest and most powerful unions of Latin-America. It has grown under the control and organised corruption established by the PRI (Institutional Revolutionary Party) throughout the last 60 years.

**72:** The teachers' union of Oaxaca is a powerful organisation with more than 55,000 members throughout the state. Its initial purpose was to safeguard the interests of the education staff of the state, but its functions have grown, taking on duties originally carried out by the state government, and becoming a powerful extreme left-wing political organisation.

**72→73:** The power and political influence of the teachers' union enables it to obtain more money from the state authorities.

**73:** c.f. section 2.4.

### Box 4.6. Power of the teachers' union of Oaxaca state

*'There are about 55,000 members in the whole state. The union of the Oaxaquenan teachers is one of the groups that struggled to create a national union distinct from the previous one, which was nothing more than the federal power, which is just a stooge. We finally created the 'national coordination group of the education staff', which is not recognised as a union yet, but which is independent of the national union. Through this group, we managed to get paid better, so now other states are asking for our support and joining us. The union organised the strike in Mexico City during May 2000 and it has caught the attention of other professional branches. The union has woken up the other people so that they can claim their rights, whereas everything used to be done by the sham-unions. You know, people of Oaxaca state have been ripped off. The staff of the public health, the police, they hardly ever get paid...'*  
MI34 - Benjamin Director 3

*'The teachers' union, long associated with radical activity in Oaxaca, exerts a powerful influence in even the most isolated regions. Allegations that it is acting as a front for the EPR (Popular Revolutionary Army) suggest that the government now suspects the rebel groups*



*have a far more advanced political organisation than first thought. Indeed, the union has a sophisticated legal and media strategy which could make a heavy-handed counterinsurgency approach by the government very costly. ' (Simon 1996)*

## 2.8. Concepts 72, 71, 55, 13



**72:** c.f. section 2.7.

**72→71:** The power of the teachers' union is such, that it is able to protect its politically active members, regardless of their ability as teachers. The outcome of conflicts between an active member of the teachers' union to a third party is usually resolved in favour of the union.

**71→55:** The strong protection the teachers' union provides for its members encourages some teachers to neglect their responsibilities at school. At the worst, if they behave very badly, they can get fired and be sent to another school, as happened to one teacher of Morelos primary school.

**55:** Three school staff members (two teachers and the director's assistant) do not do their job properly. They are not punctual and frequently leave their classrooms during their duty hours to drink alcohol together or to get some food from outside, while the children play noisily and disturb the other groups. They let their pupils call them by their nicknames and swear openly.

### Box 4.7. The protection of the teachers' union

*'All the teachers belong to the union, which permits them to benefit from its protection. There is a certain impunity. You need to be active to enter the syndicate, you need to have an activist life 'de grillo de lucha', to obtain better social conditions and to be respected. ' MI26 - Anabel (teacher)*



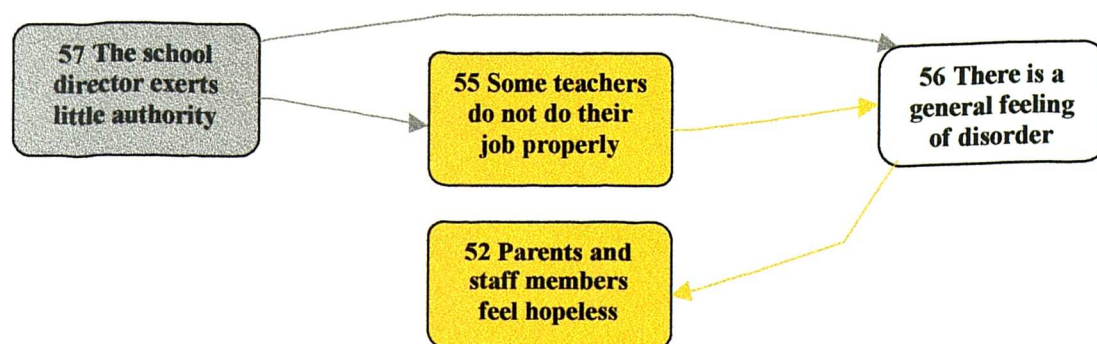
*'It is something we cannot fight against. There is a union that supports the people that are being fired from schools, because they drink, [because they have a hangover], because they don't work. It [the teachers' union] helps them, it prevents them from losing their job so that they can keep teaching.'* MI25 - Anabel (teacher)

*'For instance, if I want to fire them [the troublesome teachers], I'll be more in trouble than them if I denounce them! Because the union will protect them anyway. Its vice is to protect without any distinctions.'* MI34 - Benjamin (school director)

**55→13:** The attitude and manners of some members of the staff hinders hygienic behaviour to improve at school. Teachers who drop litter influence the pupils and jeopardise the efforts undertaken by other members of the staff.

**13:** c.f. section 2.3.

2.9. Concepts 52, 55, 56, 57



**57:** The director of the primary school lacks authority. He is unable to enforce the rules of the school.

**57→55:** The director does not have the authority required to make sure that all the teachers undertake their job effectively. He does not manage to make them more punctual. He allows some teachers to take a break during the day to drink alcohol, and does not ensure that they teach properly.

**57→56:** By failing to enforce the rules of the school, the director fosters an atmosphere of indiscipline and disorder in the school.

**55:** c.f. section 2.8.



**55→56:** The attitude of some staff members (lack of punctuality, use of slang with the pupils, food or alcohol breaks during working hours) makes the school look disorganised.

Box 4.8. Lack of authority and disorder

*'I told the director: 'You're like a dad for them...', [but the teachers] they already know how to deal with him. He cannot obtain anything from them any more because they control him. We thought that an option could be to change the director' MI16 - Candida Lopez (pupil's parent)*

*'What I saw is that the director is very docile. There is no authority over there, everybody does what he wants: the uniforms, the teachers, the meetings, the tequios...this is a real disorder there.' MI23 – Olivia (pupil's parent)*

*'Yes, that is it, "they control him...he is motivated but he lack, how did you say? ...yes, he lack authority, that is it...he lets himself led...they impose themselves on him.' MI24 - Maxima Morales (pupil's parent)*

*'Yes, it is true, we have these two teachers. I've given them a chance. We had agreed the rules at the beginning of the year, they did not respect them. I warned them again, and now I am going to find a way to fire them. I told them that we are not children any more, we are experienced teachers, and I will not let people tell bad tales about me. We have to be responsible. But now, I have to tell you that there are worse schools in the area, the same phenomenon occurs everywhere, and many people don't want to send their children to another school for this very reason: because it is not necessarily better in the other schools around here.' MI34 - Benjamin (school director)*

**56→52:** Many parents notice the apparent state of disorder at school. This tends to put off those who are concerned about the education of the children.

**52:** Many parents and some of the more respected teachers both by the pupils and their parents feel powerless, unable to make things better at school. They feel that all their efforts and involvement are not rewarded.

Box 4.9. Feelings of hopelessness and disillusion

*'I got tired of this school. 'I'm going, anyway', I said. And then I thought I'd better stay and try to help the people improve the situation. But I mean, when you find yourself with so many obstacles... I have felt completely disillusioned...' MI25 - Anabel 1 (teacher)*

*'There are teachers who do not teach...this teacher yes, but ...[these one] they go to the shop, No way, they have to do their work. The teacher told us that she was going to leave. I told her that I am going to take my child out. He has been with her two years [...] I don't trust them [these other teachers].' MI20 – Isabel (pupil's parent)*

*'The real truth is that sometimes I am disillusioned. People do not really get involved...we need more. 'MI30 – Felicitas (teacher)*



## 2.10. Concepts 57, 59 69, 52



**57 & 52:** c.f. section 2.9.      **69:** c.f. section 2.7.

**69→59:** Widespread corruption incites the leaders (or anyone with more power than the average citizen, such as a policeman) to be chiefly motivated by their self-interest, and to benefit as fast as possible from their position. This cultural background helps understanding why the two previous parents' committees of the school were both involved in fraud.

**59:** Members of the two previous parents' committee of the school were involved in fraud. Money destined for the upgrading of school facilities was stolen from the cash box of the parents' committee.

**57→59:** The lack of authority of the director and the atmosphere of disorder and indiscipline he tolerates at school creates a favourable context for corruption. People can see that the director is unable to control inefficient members of staff. This is an environment where fraud can easily take place.

**59→52:** The repeated fraud that occurred in the school has contributed to a growing feeling of disillusionment and hopelessness amongst parents and some staff members.

## Box 4.10. Corruption, fraud, and disillusionment

*She explained that the treasurer of the last committee had borrowed some money from the parents' contribution. It happened on the quiet, only a few people of the committee and the director got to know about it. We the parents discovered this when they presented us the accounts: \$2000 was missing. The director did not even say anything. We had to make the treasurer sign three papers to commit himself to reimburse the money. He finally did it when he felt people were going to take his case to court. MI17 - Candida Lopez 2 (pupil's parent)*

*J: 'And how do you see the issue of the toilets that were recently built here in the school?'*

*E: 'The work was not well planned... the money was wasted'*

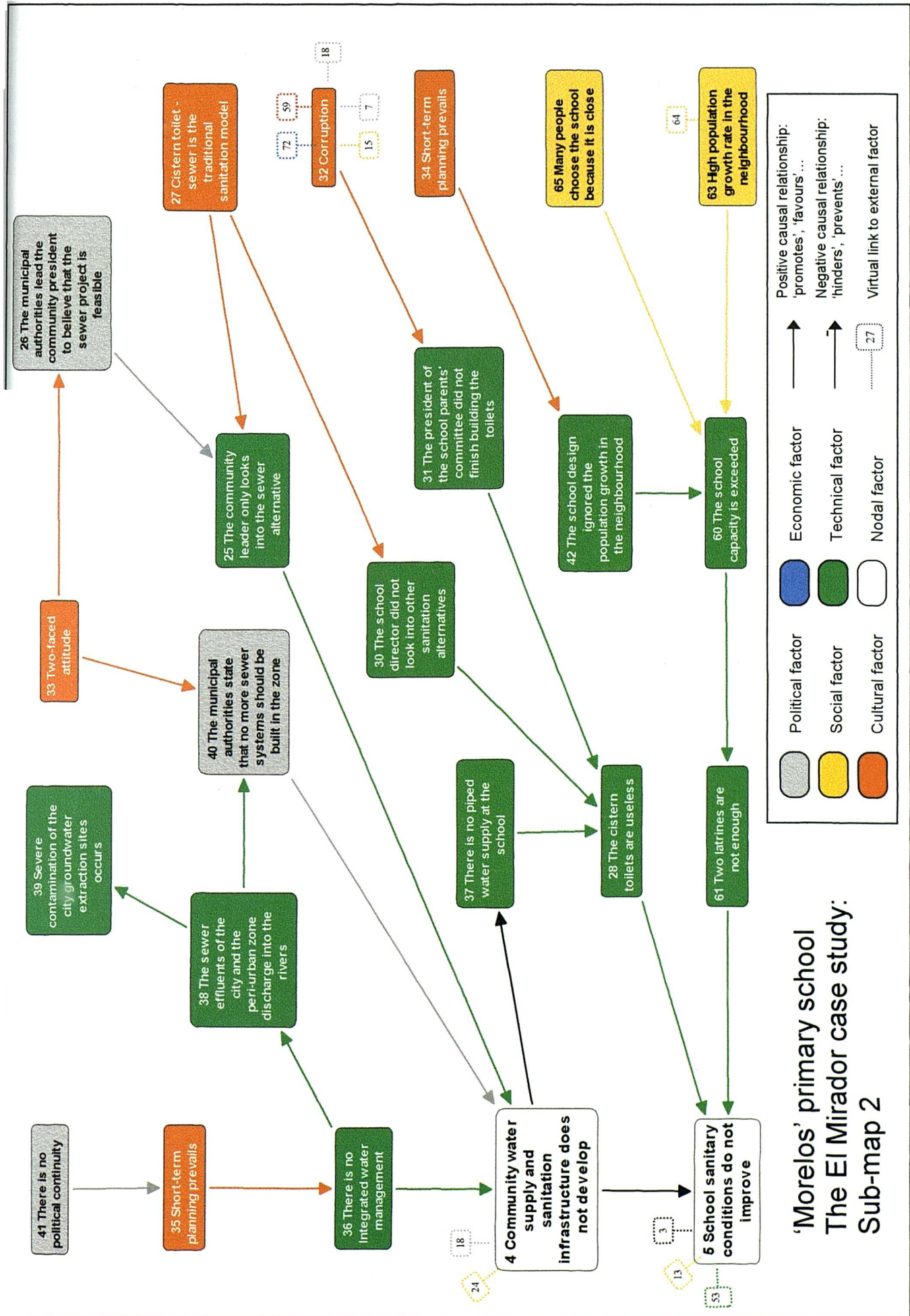
*J: 'Who did the work and when?'*

*E: 'The parents' committee of the school did it about a year ago.'*

*B (director): 'The president of the committee was a kind of mason, he contracted another mason and hired workers. He took the money with him...' MI31 – Ernesto (interview with Ernesto, teacher, and Benjamin, director of Morelos primary school)*

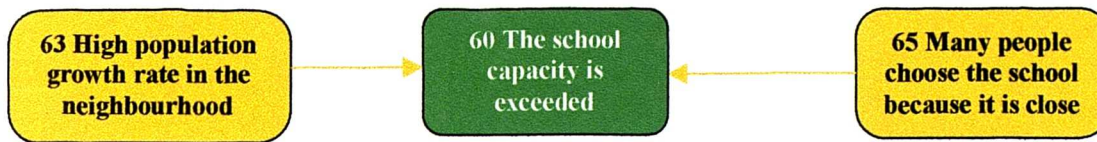
*'There is another thing, what a shame...in the previous committees, the treasurers took the money with them'. And so the people wondered: 'Why should I co-operate if this man is going to take the money?'' MI25 – Anabel (teacher)*





### 3. Sub-map 2

#### 3.1. Concepts 63, 60, 65



**63:** During the 80s and 90s, the southern part of the peri-urban zone of Oaxaca City was one of the fastest growing areas of the whole state (c.f. section 2.1.). Not only has the population of El Mirador increased: new communities have recently developed in the neighbourhood, where most of the pupils come from.

**63→60:** Since its creation, the pace at which the school has grown has been far too slow to cope with the high population growth rate in the surrounding colonies. The number of pupils almost doubled between 1995 and 2000, from 104 to 204 pupils.

**60:** Though a new classroom was built in 2000, the school capacity is exceeded: three pupil groups are still packed into metal sheet ‘temporary’ classrooms, and two latrines are much too few for 200 pupils. (The number of people per toilet in refugee camps is recommended to be less than 20 (The Sphere Project 1998))

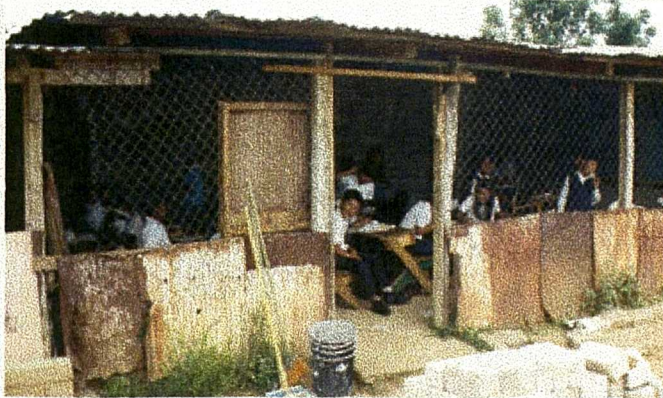
**65:** Only a few of the recent communities have their own school and many people send their children to Morelos school because it is the closest one. It saves them money and time.

**65→60:** Children from all the recent communities surrounding El Mirador come to Morelos school because of the short distance. As a consequence, the number of pupils has increased very rapidly during the 90s.



## Box 4.11. Overloaded infrastructure

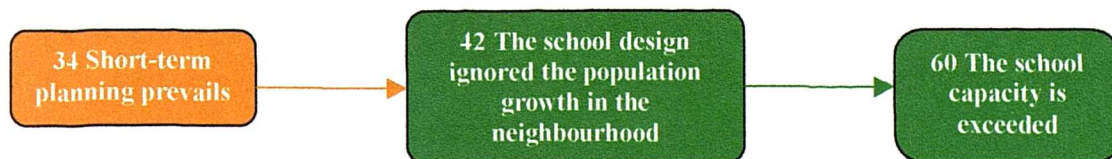
Figure 4.7. A group of pupils packed up into a 'hen-house' 'temporary' classroom



*'My son is in 4th grade and he cannot [multiply or divide]. In other schools this is taught. The level is lower than in other schools...I was about to change his school, but the school is the closest one...[We keep talking about this] with my husband to see where we are going to move him' MI18 – Elisabeta (parent)*

*They have been living here for four years and they chose the school for financial reasons [...] She explained that by sending her child there, she would save lot of money on transport. She chose the school because of the distance and at that time, she was pregnant. She feels better knowing the boy's closer to the house. MI18 – Elisabeta*

## 3.2. Concepts 34, 42, 60



**60:** c.f. section 3.1.

**34:** At all levels of Mexican politics, from the council of a small community to the state and federal governments, people tend to focus on the immediate requirements of a situation and fail to consider long-term changes.

**34→42:** The alarming speed of development of the peri-urban zone of Oaxaca City since the 80s required a strong body to plan and control urban development. However, no institution efficiently supervised the urbanisation process in this complex area embracing eight municipalities. Agreements were made to meet short-term interests of the authorities and the development goes on in a very chaotic way. Thus, in 1994-1995, when the authorities decided to upgrade the very provisional infrastructure which the community had built on its own, they ignored the effects of the high population growth rate in the neighbourhood on the number of pupils in the school.

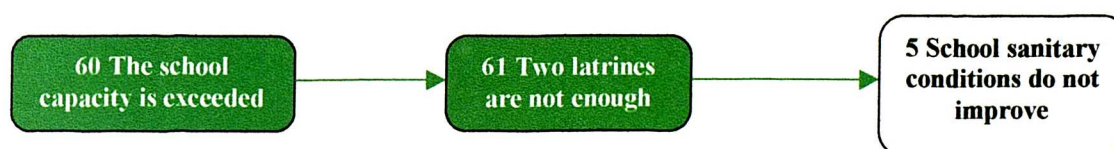
**42→60:** The ‘planners’ considered the needs of the moment: they built an infrastructure for 60 pupils. Six years later, 204 pupils, mostly from the recent, fast growing communities, study at Morelos primary school.

Box 4.12. Lack of/short-term planning and the school design

*‘But here, this is all new, totally new. This planning culture of socio-economic evaluation of projects, it is like when the Spanish came to Mexico: that is really something else! Here they live day by day, that is the culture.’ MI61- Villalobos (director of the Development Planning Commission for the states of Oaxaca and Guerrero)*

*‘Here in Mexico, we have a bad habit, we never think of the future. This is our limitation... We never plan, we have closed minds, I assume this is due to ignorance. This school is very small... it was never thought that it [the colony] would grow very quickly.’ MI30 – Felicitas (teacher)*

3.3. Concepts 60, 61, 5



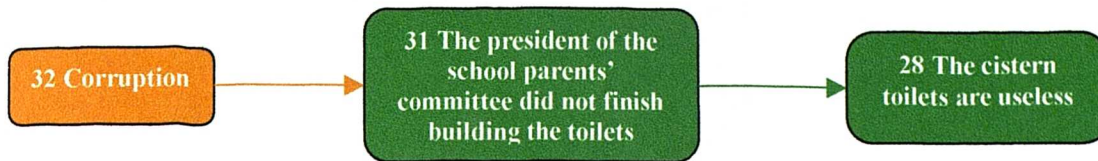
**60:** c.f. section 3.1.    **5:** c.f. section 2.2.

**60→61:** 204 pupils are too many for the school’s two latrines. Often pupils are seen queuing, waiting to use the facility.

**61→5:** As the capacity of the latrines is exceeded, they smell and fill up more rapidly.



### 3.4. Concepts 32, 31, 28



**32:** c.f. concept 69 section 2.7.

**32→31:** The fact that corruption is omnipresent in Mexican culture makes the idea of committing a fraud more tolerable.

**31:** The pit of the new toilets was badly made: it has no concrete base and the walls and the structure got flooded during a heavy rainfall in 1999. Rudimentary, unfinished brick walls are in danger of collapsing (see Figure 4.8.). The president of the parents' committee, who built this structure, left without finishing the work. It seems that he only spent part of the budget on this project and kept the rest for himself.

#### Box 4.13. Five useless cistern toilets / Incomplete sanitation project

Figure 4.8. The unfinished new toilets



*Isabel told the story of how they had been ask to contribute (\$50) to building up new toilets and that 'the president (of the committee) who was supposed to make the toilets stole the money' MI20 – Isabel (pupil's parent)*

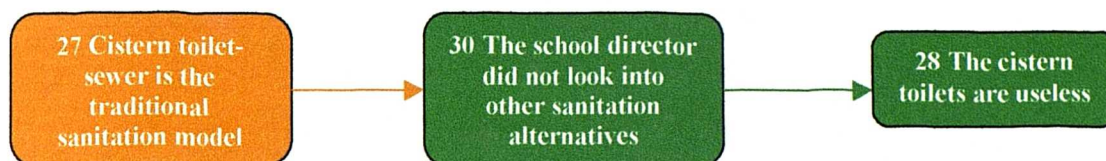
*'In the committee of last year (the one who built the toilets), the president was a mason and the treasurer was contractor, and they seized the money. Furthermore, they asked for two contributions of \$50 from every father. [The treasurer then] set up his own shop in the residential zone. He took his daughter out of the school and put her in Mineria [Mineria school]' MI27 – Marguarita (teacher)*

**31→28:** The state of the sanitation facility makes it unsuitable for use.

**28:** The recently built toilets do not provide the adequate safety and privacy. The absence of piped water supply makes it inappropriate to use.



### 3.5. Concepts 27, 28, 30



**27:** The construction of a sewer system in a community is generally perceived as the normal development step after the installation of electricity lines and potable water supply network. People feel upset if they do not receive this service. They feel excluded from the national development trend. People living in communities expect to enjoy the comfort that the cities provide: the ‘flush and forget’ sanitation. The official statistics realised by INEGI often exclusively quantify the level of sanitation using the ‘sewer coverage’ indicator (expressed as a percentage of the population) (INEGI 1997; INEGI 1998).

**27→30:** Cistern toilet – sewer system is usually regarded as the only appropriate sanitation technology. This common perception influences the choice of the director and the staff who want the best for their school.

**30:** The director of Morelos primary school, his assistant, and most teachers believe that the flush toilet and sewer system is the only way to make significant improvement in sanitation at school.

**30→28:** The director brought five cistern toilet seats for the school. He did not consider other alternatives, such as dry sanitation, or ventilated pit latrines, that are probably more appropriate, given the lack of piped water supply at school.

**28:** c.f. section 3.4.

#### Box 4.14 . Sewer system, the norm for sanitation development

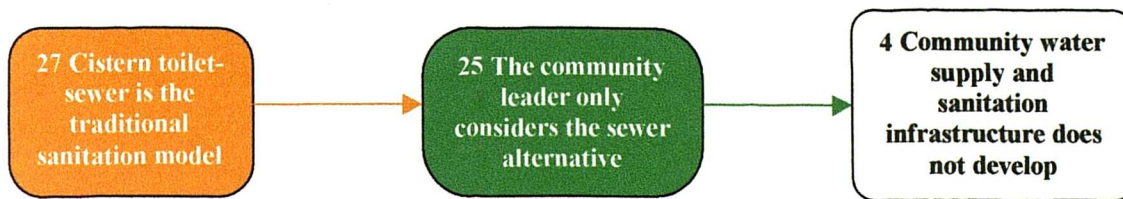
*‘We need a sewer system for the colony and for the school. We also need drainage for the rainfall runoff. There is no electricity in the neighbouring colonies and in most parts of El Mirador. Downhill in El Mirador, they have sewer system and electricity. The habitation zone further downhill got all of this.’ MI32 – Dimas (director assistant)*

*‘One thing I know is that the sewer system is really needed in that school.’ MI6 – First community settler*



*'In 1997, I was president of the parents' association of that school. When the problem of the latrines became critical because of the smell, the teachers started to say that they could not go on like this, that the children could not use these toilets any more because they could collapse and everything... "We went to check and we came to the conclusion that the latrines were ok but that they had to be emptied. I proposed ecological toilets. The director opposed ecological toilets, he regarded them as filthy. [I said that] they should let us, the parents, decide. We had a dispute with the teachers.' MI2 – Community ex-president 1*

### 3.6. Concepts 27, 25, 4



**27:** c.f. section 3.5.

**27→25:** The president of the community council is influenced by the conventional perception of sanitation and only thinks in terms of cistern toilet – sewer system option for El Mirador.

**25→4:** The excavation costs for the introduction of a sewer system in every part of El Mirador are high and the community is not likely to be able to afford such a project. Besides, the municipal authorities do not support the installation of new sewer networks in the neighbourhood any more, due to severe river and groundwater contamination by untreated sewer discharge (*see concepts 38, 39, and 40 section 3.9.*). As a consequence, the failure of the community leader to consider alternative technologies for the village hinders the development of water and sanitation facilities in the village.

**4:** Community water supply and sanitation infrastructure does not develop. After almost twenty years, most people in the community have very rudimentary sanitation facilities, and water supply is an important issue for many dwellers.

#### Box 4.15. Water supply and sanitation facilities

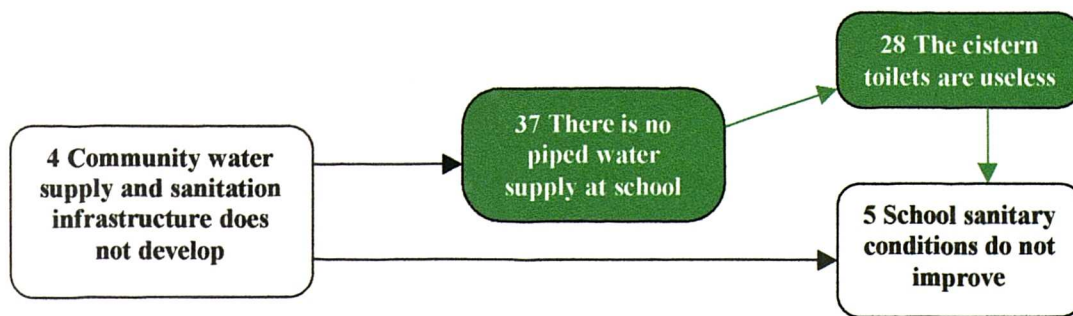
*In El Mirador and its surrounding communities most people usually have their own well in their garden. According to the season, the groundwater table level varies from 4m to 5m in the bottom part of El Mirador, and from 14m to 15m at the top. As a consequence of the mean size of the parcels (about 20m x 10m), the wells are often located quite close to the defecating sites, which mainly consist of pits with ecological toilet seats (urine/faeces*



*diversion). Only a few people have an impermeable disposal tank for the excreta. There are thus potential risks of bacterial contamination of the well, especially during the rainy season, when there is considerable surface runoff on the slopy ground of El Mirador. MR6 - Municipality of S.C. Xoxocotlan*

*According to the official data, 50% of the dwellings in El Mirador have a septic pit (the type of construction is not specified, i.e. simple earth excavation, brick soakaway pit, or concrete septic tank...) Most of these septic pits are merely simple earth excavations under toilet seats. The inhabitants of El Mirador get their water from private wells. In April 2000, in the bottom part of the village, many septic pits filled up and their effluent overtopped, mixing with the well water in a very critical way. MR6 - Municipality of S.C. Xoxocotlan*

### 3.7. Concepts 4, 37, 28, 5,



**4:** c.f. section 3.6.      **28:** c.f. section 3.4.      **5:** c.f. section 2.2.

**4→5:** Lack of development of the community water supply and sanitation infrastructure hinders the improvement of the sanitary conditions at school.

**4→37:** The development of water and sanitation infrastructures in the community could be achieved by the construction of a potable water network. In El Mirador, the absence of a piped water network can be seen as a symptom of the lack of development of water and sanitation infrastructures.

**37:** There is no piped water network in the community or at the school. The school relies on a cistern tank that is filled regularly and that is mainly used for cleaning purposes. (There is no source of water for drinking or hand washing at school)

**37→28:** The recently built cistern toilets are useless due to the lack of a piped water supply in the school. Potentially they could be flushed by pouring water from a bucket, but filling this bucket from the cistern is not practicable.



**28→5:** The cistern toilets are useless. Failure of this sanitation project does not improve the sanitary conditions of the school.

Box 4.16. Piped water supply network

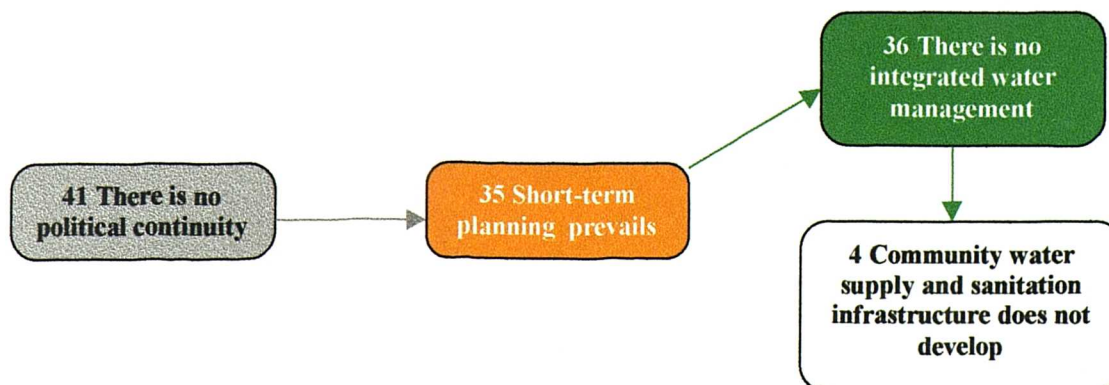


**Figure 4.9. Unused cistern toilet**

*A failed community water supply project*

*In 2000 there is still no piped water supply network in El Mirador, although a deep well (around 36m deep) was drilled in 1994. Investigations carried out by the CIIDIR (research centre for regional development) had recommended a depth of 96m. The community committee chose the drilling company from three firms. According to Alvarado (ex-community leader), the company and the committee member in charge of the issue committed a fraud. The people had agreed to pay 147 000\$ for a 96m deep well, but the company (very probably with the complicity of this member of the committee) finally charged them 150 000\$ for a 36m deep well. When the company left (the committee had released it from its contract), the people realised that there was not a sufficient discharge. The CIIDIR came again and stated that the well had to be drilled at least to 50m. However, to date, this frustrating issue remains unresolved. MR6 - Municipality of S.C. Xoxocotlan.*

3.8. Concepts 41, 35, 36, 4



**4:** c.f. section 3.6.

**35:** c.f. concept 34 section 3.2.

**41:** The politicians know that their task is temporary as their mandate is short (especially at community and municipal level, where it is for three years) and successive terms of office are not permitted. Most of the people with managerial posts in the municipal government are replaced every three years. There is little political continuity



in Mexico, especially at state and municipal levels. At the beginning of a new mandate, local governments tend to start everything from 'zero' again, regardless of what the previous team accomplished.

**41→35:** Lack of political continuity makes it difficult to undertake the planning of medium to long-term projects. The politicians rarely embark on medium to long-term programs, assuming that such efforts will be not be pursued by their successors. It is normal to think in the short-term and to achieve things within the mandate period.

**35→36:** The prevalence of short-term –or the absence of– planning hinders the integrated management of urbanisation in the peri-urban zone of Oaxaca City. Water management, notably in the neighbourhood of El Mirador, is affected by the lack of a long-term vision for the development of the area.

#### Box 4.17. Lack of political continuity and short-term planning

*'The presidents are often used to thinking of what they can do within 3 years, without really considering the future of the district, without launching any medium to long-term programs.'*  
TI17- Municipal president (Tepezalá, case study No.1)

*'We live in a community, and every 3 or 6 years, the big politicians come here with their proposals, promises, they involve the people saying: "We want San Luis Beltran to change", this influences a lot of people. There was a government that got interested in ecological toilets, and another government preferred the sewer system because it looks more modern.'*  
SI17- Rogelio Ruiz Angeles (San Luis Beltran, case study No.3)

*'The government already had a program with a budget for around 15 000 toilets per year, some communities were doing it for themselves, with funds from the World Bank, Banamex, Unicef, anyone...they'd find the finance to build the toilets. So this was really a program that was achieving results in the field, and in people's mentalities. And then another government arrived, they wanted to erase everything, on the pretext of the modernity and they negated the work of 5-6 years that had very valuable results.'*  
SI20- Enrique Vignau, Espacitos (San Luis Beltran, case study No.3)

*'What happens is that the planning needs to be preventive, and here in Mexico, it is the opposite: we run after the thief, the police follows the thief, the police never hunts him down, this is what happens in Mexico, especially in our villages. The population settles and the government comes to lay out the streets, and then they bring electricity and water. But first the people settle in an irregular way, which of course provokes social instability, physical problems, which is why we have critical issues when a hurricane or an earthquake comes. Because there is no planning. But planning implies a vision for the future. [...] We are always correcting, correcting. [...]'*  
SI4- Armando Ramirez (San Luis Beltran, case study No.3)



**36:** There is a serious lack of planning in the development of the peri-urban zone of Oaxaca city with regard to water management. There is no overall scheme for managing water and wastewater altogether. On the contrary, the peri-urban municipalities and communities solve their problems independently, without considering the overall impact of their projects.

**36→4:** This lack of integrated water management is detrimental to the sustainable development of water supply and sanitation infrastructure, especially for human settlements of densely populated peri-urban zones, such as El Mirador. For instance, El Mirador is affected by the upstream sewer discharges into the river Nazareno, which flows past the village.

**Box 4.18. Lack of integrated development**

**Figure 4.10. Chaotic development of recent settlements**

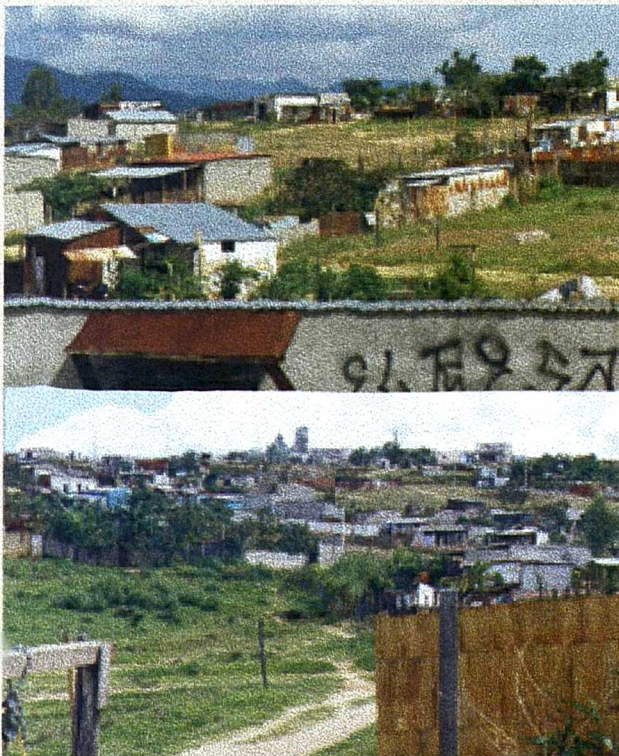


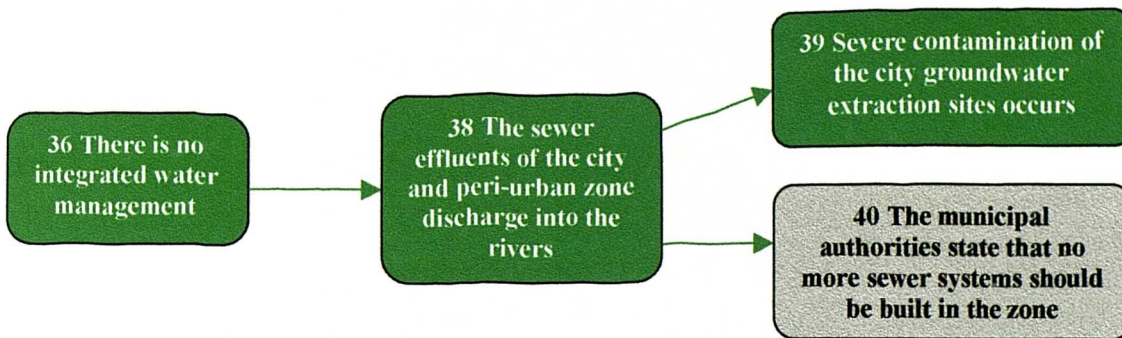
*Figure 4.10 shows two recent communities (El Benemerito and La Soledad) that have mushroomed in the neighbourhood of El Mirador during the 90s.*

*The non alignment of the building plots makes the introduction of public services (electricity, piped water supply, sewer system, road pavement) much more difficult)*

*'There are institutions [that are supposed to plan this development], but it is like the law: we have a well made law, but the problem is how to apply it. Because who is going to impose some order over there: the municipal authorities?...'* MI7 - Delegate of the state government



### 3.9. Concepts 36, 38, 39, 40



**36:** c.f. section 3.8.

**36→38:** The lack of integrated wastewater management in Oaxaca city and its peri-urban zone results in the discharge of untreated domestic wastewater into the environment. The capital and maintenance costs of a wastewater treatment plant are far too high for each municipality, and the solution of constructing one treatment plant for the city and the peri-urban zone requires an integrated approach to water and wastewater management.

**38:** Most of the wastewater produced in the zone consists of domestic wastewater, of which only a very small percentage is treated. The river Atoyac and its eastern contributors such as the rivers Salado and Nazareno (bordering El Mirador community) are the main wastewater receptors.

**38→40:** A federal law prohibits the discharge of untreated effluent into national water bodies (lakes, streams) and fines the polluters. The implementation of this set of laws is relatively recent (the municipalities and some factories have benefited from an adjustment period) but it seems that finally, it is—at least partially—being enforced. This puts some pressure on the municipal authorities, who have to consider the implications of the sewer ‘flush and forget’ sanitation approach.

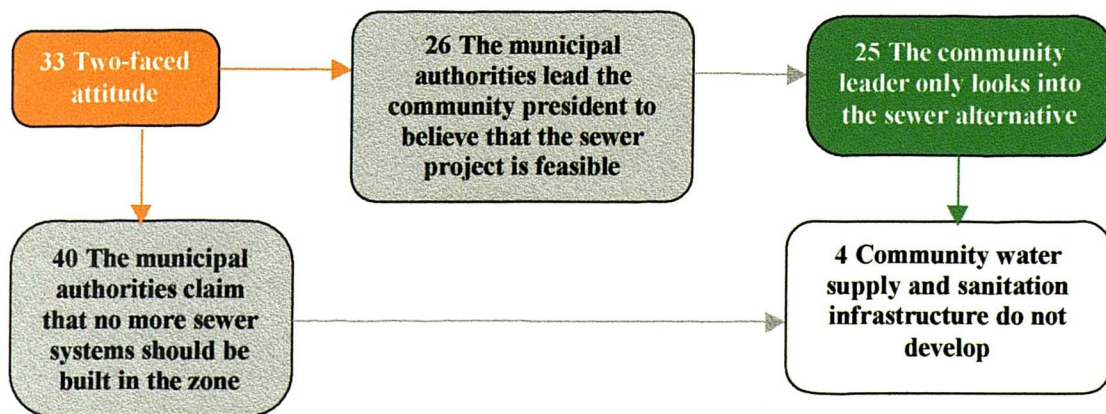
**38→39:** These highly contaminated rivers feed the underlying aquifer during most part of the year, subsequently a critical level of groundwater contamination ensues, especially through seepage from the river Atoyac in the southern part of the city.

**39:** The potable water supply of the population living in Oaxaca City and the peri-urban zone mainly relies on a set of wells drilled at a depth of 40m aside the river Atoyac about 10km away on the southern side of the city. Pumping had to be permanently

interrupted in a few wells because they became contaminated, and the situation is likely to worsen given the absence of a wastewater treatment plant and the delay associated with groundwater contamination.

**40:** The municipal authorities know that the rivers Nazareno and Atoyac cannot continue to receive more wastewater effluent. Moreover, water availability in the zone is a critical issue. The municipal government is aware that following the conventional pattern of sewer system/pipe water network/ flush toilets would lead to disastrous consequences in the long term. Alternative environmental-friendly modes of development are needed.

### 3.10. Concepts 40, 33, 26, 25, 4



**33:** The Mexican people excel in the art of dissimulation, that is in the ability to play different roles in different contexts. This two-faced attitude, which is very notorious in politics, is part of the Mexican culture.

**33→26:** The municipal authorities lead the local authority of El Mirador to believe in the feasibility of the sewer system project.

**26→25:** As a consequence, the community leader is convinced that the sewer system will be introduced. He ignores the other alternative sanitation technologies.

**4, 25→4:** c.f. section 3.6.

**33→40:** On the other hand, the municipal authorities say the opposite to other community members and the researcher from the CIIDIR. They claim that no more



sewer systems should be built in the whole area comprising El Mirador and maintain that they will promote the introduction of ecological toilets (dry sanitation technology), which they deem more appropriate for this zone.

**40:** c.f. section 3.9.

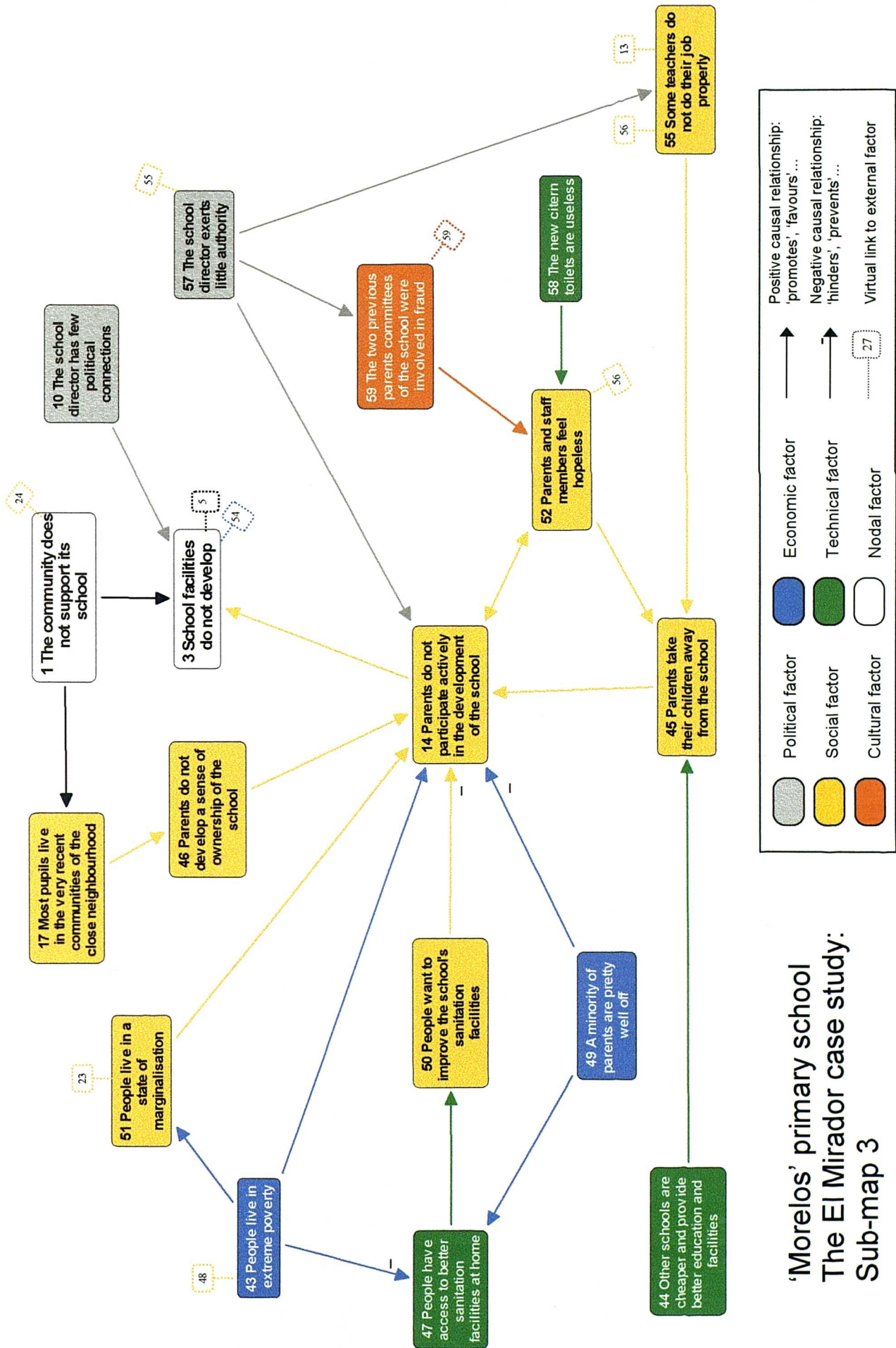
**40→4:** The municipal authorities do not encourage the extension of the sewer system in El Mirador. Thus, the community leader spends a lot of time trying to obtain the support they promise, but his sewer project does not progress. Frustration builds up as a result of this stagnation. As no alternative technology is considered, the community sanitation infrastructure does not develop.

Box 4.19. Two-faced attitude: the art of dissimulation

*'But our mechanisms of defense and self-preservation are not enough, and therefore we make use of dissimulation, which is almost habitual with us. It does not increase our passivity; on the contrary, it demands an active inventiveness and must reshape itself from one moment to another. We tell lies for the mere pleasure of it, like all imaginative peoples, but we also tell lies to hide ourselves and to protect ourselves from intruders. Lying plays a decisive role in our daily lives, our politics, our love-affairs and our friendships, and since we attempt to deceive ourselves as well as others, our lives are brilliant and fertile, not like the gross inventions of other peoples' (Paz 1985)*

*'The succession of contradictory government announcements and Mexicans' historic skepticism about their leaders had helped to cement a feeling of political numbness in the population' (Oppenheimer 1996)*

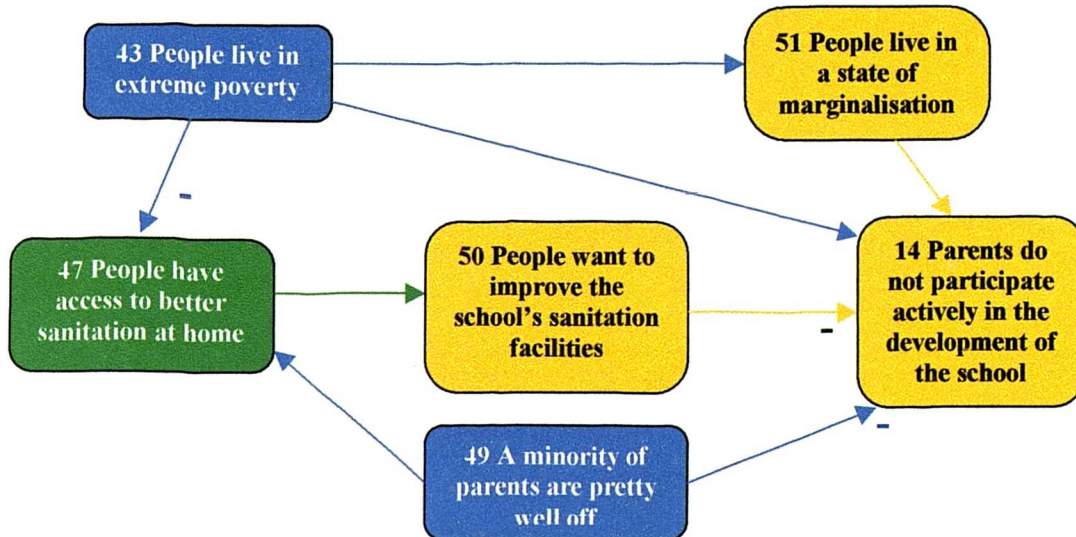
*'There was nothing new about Mexico's tradition of lying, of course. Since as far as historians could remember, double-talk and deceit had been a part of Mexico's national character. Historians said deceit was the way in which Spanish viceroys defended themselves against kings who demanded ever-growing levies from the New-World, and the Indians' way of protecting themselves against the exploitation of their Spanish rulers'. Mexicans in the colonial days would say yes to everything while doing as little as possible. Centuries later, Mexicans would sum up this national tradition with the saying "Obedezco, pero no cumplo" ("I obey, but I don't comply")' (Oppenheimer 1996).*





#### 4. Sub-map 3

4.1. Concepts 43, 47, 49, 50, 51, 14



**43 & 51:** c.f. concept 74 section 2.1.

**43→14:** The high level of poverty hinders the participation of parents in the school. Many parents who come to the school meetings stop being involved as soon as a financial contribution is required.

**14:** Parents do not participate actively in the development of the school. They hardly ever come to the school meetings, to vote on projects and to contribute to the development of the school, either financially or through *tequio* (i.e. mutual help tradition, *for more details see glossary*).

**43→51:** c.f. 64→74 section 2.1.

**51→14:** Many parents are marginalised, which negatively affects their participation in the development of the school. Several parents just appear twice a year at school: the first time for the registration of their child, the second to get the end-of-year report.

**Box 4.20. Poverty, marginalisation and school participation**

*J: According to you, what are the reasons that can explain the state of sanitary conditions at school, and more generally, the bad state of the school's facilities?*

*I: The parents do not co-operate*

*J: And why don't they co-operate?*

*I: They lack resources [...] there are fathers with many children who haven't got a job, there are single women who work but earn very little.*

*J: Lack of interest as well*

*I: Yes, some register their children (at the beginning of the year) and do not appear until the end of the year. MI29 – Isabel (teacher)*

*'Some are irresponsible [...] they are not interested in knowing if their children study well [...] the ones who come are the ones who look after their children [...] the others don't give a shit'. MI13 – Celestino (president of the parents' committee)*

**43→47:** Most people who live in the neighbourhood of El Mirador (most pupils come from the neighbourhood, and not from the community itself) have very little money to build a proper house after they purchase their land parcel. The money is first spent on building a basic lamina shack (see pictures 5 and 6), digging a well, buying a T-V set...The sanitation facility usually consists of a rudimentary pit latrine, which does not get upgraded until many other priorities are met. In many cases, the sanitation technology used at home is more rudimentary than the concrete, brick building, pit-latrines of the school.

**49:** A minority of the parents that send their children to Morelos school are reasonably well off, that is, they can meet their most basic needs. Most of them live in the Aguayo residential zone, at the bottom of El Mirador (see Figure 4.11.).

**49→14:** Parents that are quite well off tend to participate actively in the development of the school.

**49→47:** Most of the people that are reasonably well off use a cistern toilet and have access to the sewer system

**47:** These people's home sanitation infrastructures are better than the school pit latrines.

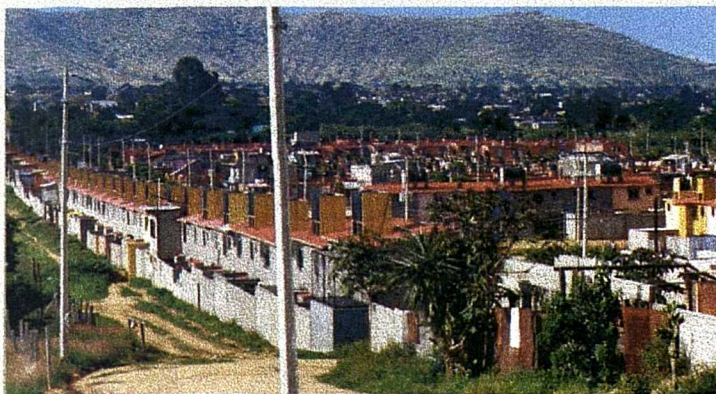


**47→50:** Enjoying better sanitation at home encourages the well-off parents to improve the school sanitation facilities. As many families have worse sanitation facilities than that of the school, they do not see any urgency to improve sanitation at school.

**50→14:** People who have better sanitation at home than the school pit latrines want to improve the situation of their children and tend to participate more actively in school projects involving sanitation development.

**Box 4.21. Sanitation at home and parents' participation in school sanitation projects**

**Figure 4.11. Aguayo residential zone**

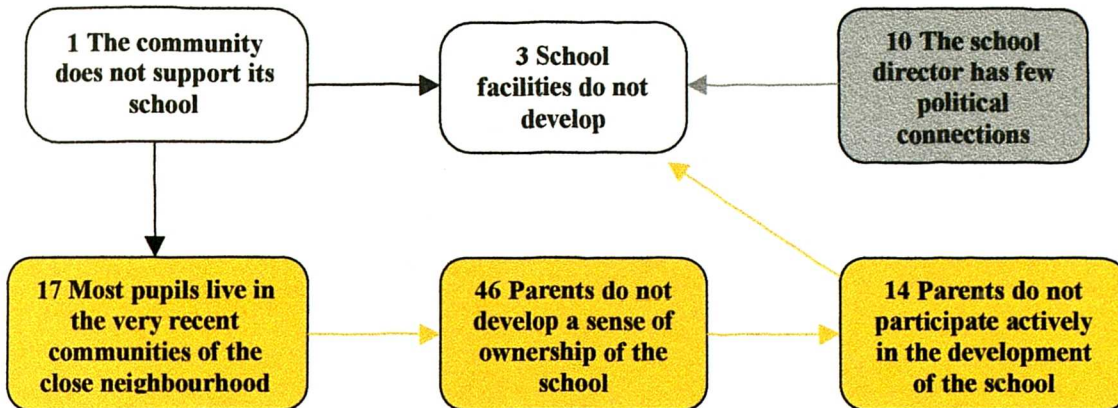


*'Very few have [proper toilets at home ]. These people say they cannot [contribute to the construction of new toilets]. However, the current state of sanitation at school 'affects the ones who have [proper toilets at home], that is, those who support more or less'. MI36 - Benjamin (school director)*

*83 percent of the pupils find that their toilet at home is better than at school. Three pupils feel that they are the same, while one prefers the toilets of the school. Most people have rudimentary sanitation facilities, that consist of a shelter made of lamina, an excavated pit, and a cement toilet seat. The pupils find it better because it is not as overloaded as at school (200 persons for two latrines!). All the pupils coming from Aguayo residential zone or the bottom part of El Mirador have got flush toilets connected to the sewer system, which provides more comfort. The use of 'urine- diversion' toilet seat seems to be quite common in the zone, although it seems to be rarely integrated into a standard ecological toilet system (with two compost chambers). The use of this diversion system nonetheless reduces the odours and guarantees a certain level of comfort. Open-air defecation was not mentioned although other informants reckoned that this practise is common in the area. MR2 - Interviews of pupils*



#### 4.2. Concepts 1, 3, 10, 17, 46, 14



**1:** The community does not support its school. The local authorities and the population from El Mirador are not very concerned about the level of the education and the quality of the facilities of Morelos primary school.

**1→3:** The lack of involvement of the community in its school is detrimental to the development of its infrastructure, notably the water supply and sanitation facilities.

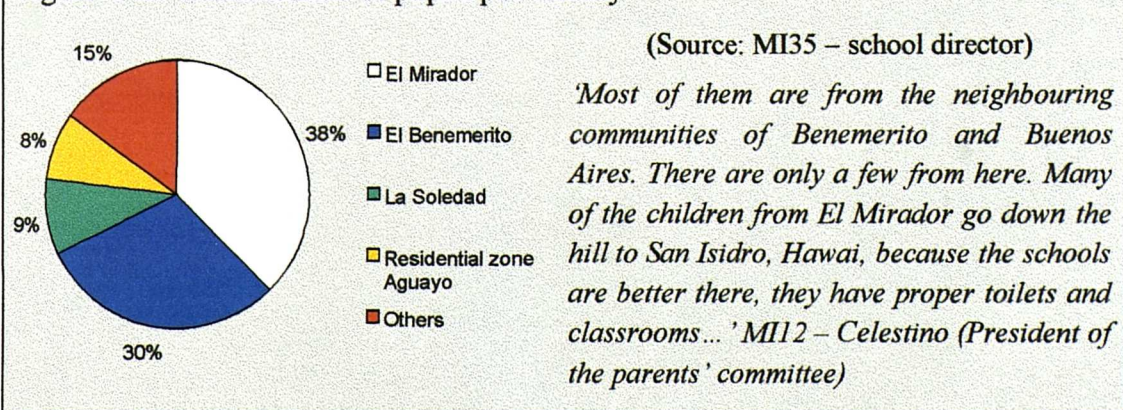
**3:** c.f. section 2.6

**1→17:** People from El Mirador are little involved in their community's school: most families prefer to send their children to primary schools in nearby communities down the hill. As a result, a minority of Morelos school pupils live in El Mirador.

**17:** Most Morelos school pupils come from the recent communities neighbouring El Mirador, such as: El Benemerito, La Soledad, Aguayo residential zone...

#### Box 4.22. Classification of pupils according to localities

Figure 4.12. Classification of pupils per locality





**17→46:** Most of the families sending their children to Morelos school do not live in El Mirador. They do not feel much involved in the life of this community. They mainly live in more recent communities, where much remains to be done. They 'use' Morelos school because it is the closest, but the fact that they do not reside in El Mirador prevents them from developing a sense of ownership of the school.

**46:** Most parents do not develop a sense of ownership of the school. They do not feel the school is theirs and that it is up to them to influence its development.

**46→14:** A lack of a sense of school ownership prevents the active participation of the parents in the development of the school. Most parents feel that because Morelos school does not belong to their community, they should not spend much time, money or energy on it.

**14:** c.f. section 4.2.

#### Box 4.23. Ownership, involvement, and participation in school

*J: How do you see the future, do you think things can improve?*

*F: 'The real truth is that sometimes I am disillusioned. I mean... how? The people don't really get involved...we need more. For instance, look, at Paraiso community, they wanted their school: they demonstrated in front of the state government building with the parents and their children...and they eventually got the school built...' MI30 – Felicitas (teacher)*

*'People come from other regions and when they see the situation, they say: Why should I give (money to the school) if the others do not co-operate' [...] I told them: 'we are going to clean and paint this furniture we bought at the start of the year and that looks bad after one year, so that next year we will have good material to work with.' And the people asked: 'why should we do that for the others?' MI25 - Anabel (teacher)*

*'In the last meetings of parents in June 2000, less than 50% of the parents were present, and no significant progress could be made since the presence of half the parents plus one is required for decisions to be made.' MR7 - Primary School Morelos*

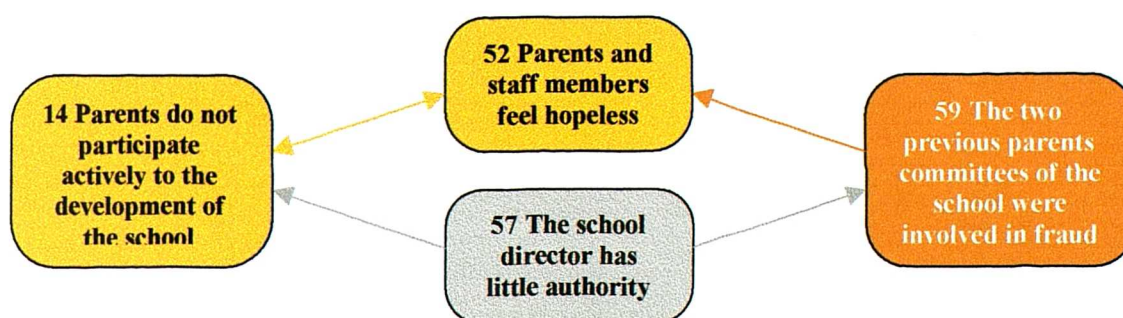
*'I say only 5% of the parents fulfil their commitments (financially and tequios). [...] The parents are apathetic, this is the main problem. We hired someone a year ago (to clean the latrines). They were paying her \$3 every fortnight to pay her. This just worked for four months and then the people did not want to pay anymore.' MI34 - Benjamin (school director)*

**10→3:** The school director has few political connections, which does not favour the development of the school infrastructure.



**Box 4.24. Influentismo – Director’s lack of political connections**

*'The influence matters very much: the influence of the director or members of the community with the state. [...] In this community, it is all a matter of politics. They not receive support from the municipality and from the state. [It cost us] so much work to build a classroom [...] I got tired, the influentismo (the power associated to political acquaintances) is the only thing that matters. In Cuilapam (municipality at the south of El Mirador), they are throwing away their classroom furniture because they have been offered great new furniture. Here it is 20 years old, and the IEEPO does not give us any new stuff.'* MI36 - Benjamin (school director)

**4.3. Concepts 14, 52, 57, 59**


**52, 57:** c.f. section 2.9.

**14:** c.f. section 4.1.

**59, 59→52:** c.f. section 2.10

**57→59:** c.f. section 2.10

**14↔52:** The lack of participation of most parents tends to make the few motivated staff members and parents feel hopeless about the situation. Likewise, this feeling of hopelessness expresses itself as a loss of motivation and a less active participation of the people most involved in the school development.

**Box 4.25. Lack of participation / Hopelessness**

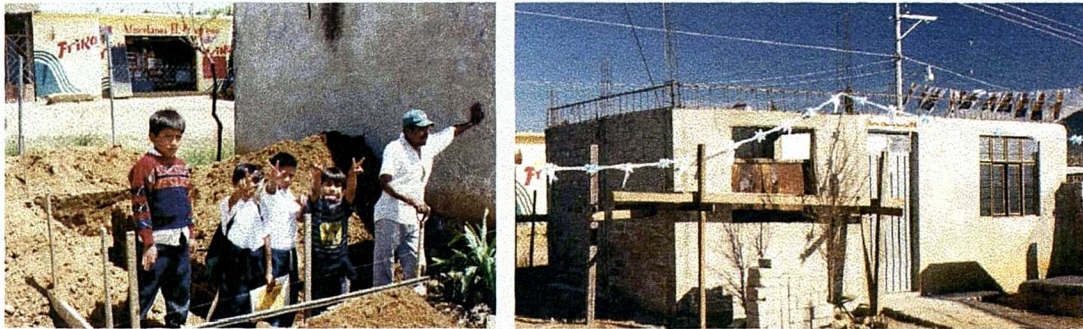
*'The real truth is that sometimes I am disillusioned. I mean... how? The people don't really get involved... we need more.'* MI30 –Felicitas (teacher)

*'In each meeting, there is less than the half. Many do not come. It's always like that, they never come, and it's the same for the financial contribution, if all do not give, then nothing gets done.'* MI18 – Elisabeta (parent)

*'At the end of the year, Anabel a 2nd grade teacher highly valued by the parents announced her departure from the school to another one closer to the city of Oaxaca. She explained that initially she wanted to stay but that she felt disillusioned realising how difficult it would be to make things improve.'* MR7 - Primary School Morelos



Figure 4.13. Celestino working on the extension of the director's office



*'Celestino (president of the committee of the parents' association) and I asked the people to help us finish the construction of the director's office. Celestino had done it all on his own but he required help to build the roof. Everybody said yes, of course, but on the day they were needed, nobody came. We even informed the people that they would have their registration fee reduced or cancelled if they'd help, nobody came. Celestino was really disappointed and confused, he said he would not belong to the committee again next year.'* MI34 - Benjamin (school director)

**57→14:** The director's failure to exercise his authority and to encourage respect for the school rules means that the parents have no incentive to participate in the development of the school.

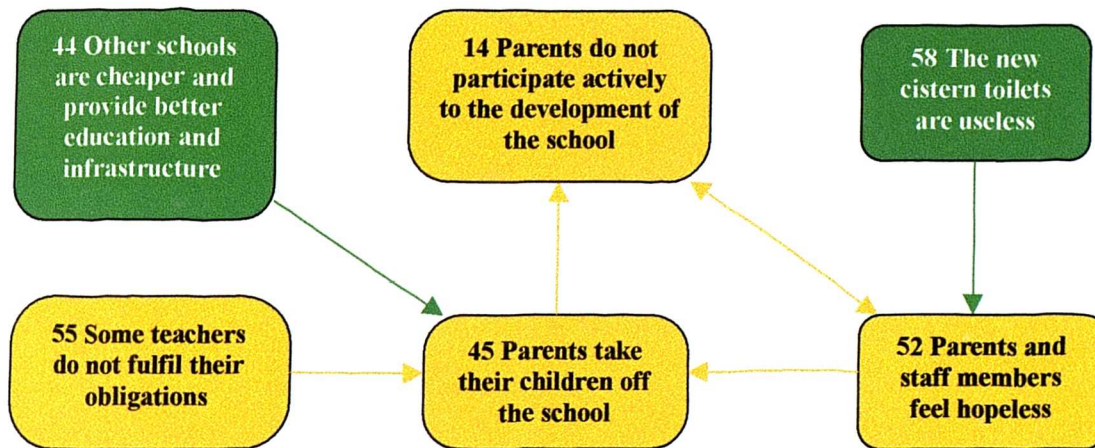
#### Box 4.26. Director's attitude and parents participation

*'What I saw is that the director is very docile. There is no authority over there, everybody does what he wants: the uniforms, the teachers, the meetings, the tequios...there is real disorder there.'* MI23 - Olivia (parent)

*I told her that I had just seen three children in El Benemerito coming back from the school in Mineria, they were all dressed in a beautiful uniform. I said that this must represent an additional cost too. She nodded and noticed that in Mineria, the director is much more intransigent. The parents also need to make an effort: if they don't participate (physically or financially) in the tequios, at the end of the year, he comes with his list and tells each parents what they have to pay.* MI17 - Candida Lopez (parent)



#### 4.4. Concepts 44, 45, 52, 55, 58, 14



**55:** c.f. section 2.8.

**55→45:** The lack of commitment of some members of the staff to do their job properly lead the parents that are most concerned about the education of their children to take them away from the Morelos school.

**44:** Some schools in communities located in the north of El Mirador provide better infrastructure and level of education. These schools often ask for less direct financial participation because there are less major improvements to be made.

**44→45:** Some schools provide better infrastructure and level of education. Consequently, the parents who accept the idea of having their children going to a school a few hundred of metres further away from home often decide to take their children away from Morelos primary school.

#### Box 4.27. Parents concerned about education take their children away from the school

*J: You mean many people are going to take their children out of here next year?*

*C: Yes, but there are new people that come to live here, they just come and send their children here, and then after some time, they decide to change school.' MI16 - Candida Lopez (member of the parents committee)*

*'There are teachers who do not teach...this teacher yes, but ...[the others] they go to the shop, it cannot be, they should be doing their work. The teacher told us that she was going to leave; I told her that I am going to take the child out. He has been with her two years and I would like him to continue with her, I don't trust them [the other teachers] [...] I'll change him [to the school] Minería, Nazareno (Cruz Blanco), I think so, [I've got to talk with my daughter...] over there they have all the facilities.' MI20 – Isabel (parent)*

*'I was selling in the co-operative (a group of women selling food in the school, for the profit of the parents association). I observed everything...There are teachers who have kids and they take them to schools in the city centre (Oaxaca City). They know the level of the school. [Many people from] El Mirador have sent them [their children] to Mineria. They don't have money to go [send them] to the city centre but they take them away from here.'* MI23 – Olivia (parent)

*'Yes, the saddest thing is that these parents from the residential zone (Aguayo) are leaving...I was happy at the beginning because with them the school was going to improve, to move forward...'* MI25 – Anabel (teacher)

**45→14:** Many parents take their children away from Morelos school after one or two years, before they finish the primary cycle. These parents are generally the most worried about the education of their children, and usually those who regularly attend the meetings of the parents' association and pay their contribution. Thus, there is a slow but continuous impoverishment of the school due to the departure of these parents. As a consequence, fewer parents participate actively and financially in the life and development of the institution.

**14:** c.f. section 4.1.

**14↔52:** c.f. section 4.2.

**58:** c.f. concept 28 in section 3.3.

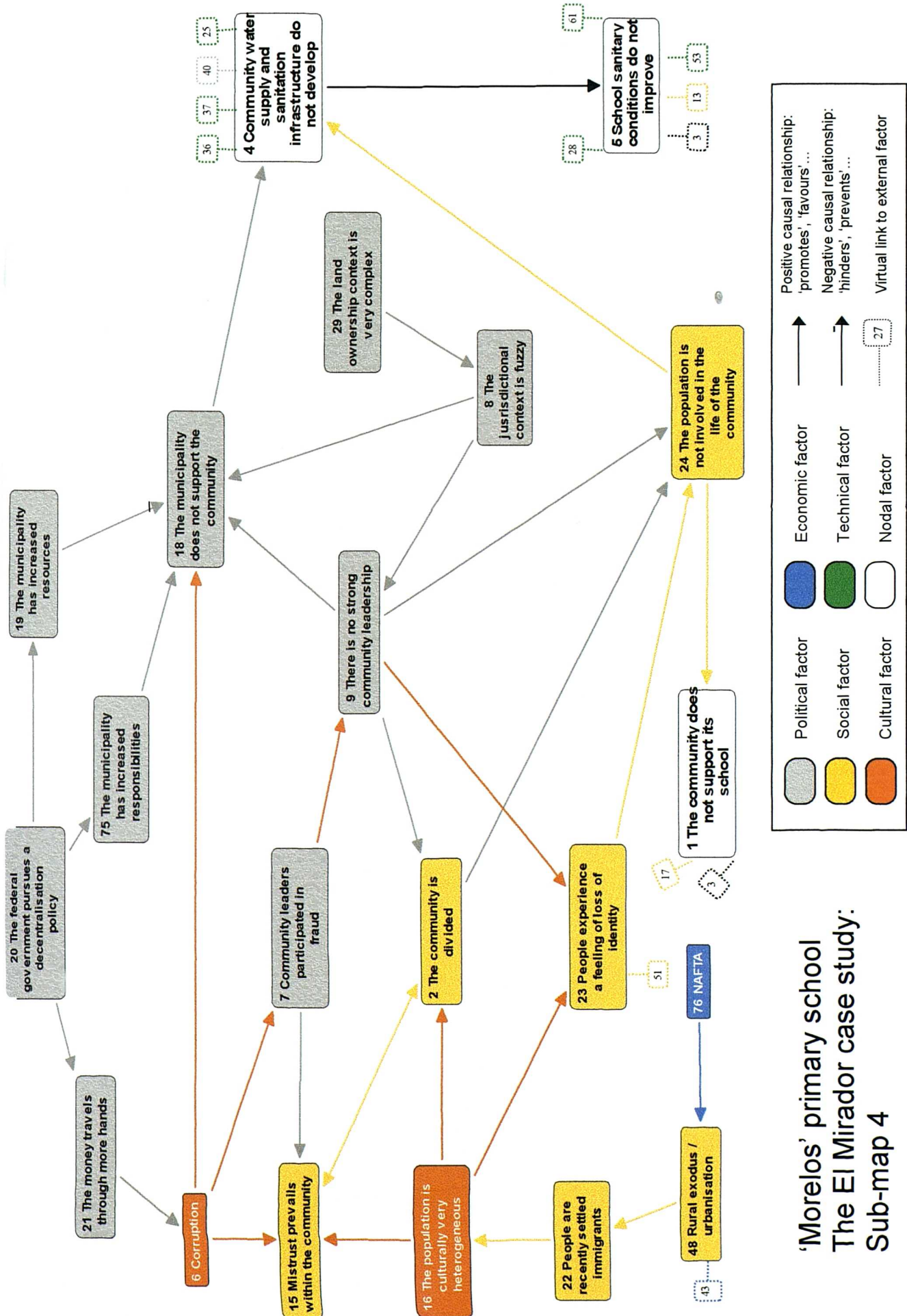
**52:** c.f. section 2.9.

**58→52:** The recent sanitation project involving the construction of new toilets failed. The facilities are not finished, so it is useless, and many parents feel hopeless and frustration from having participated in something which is absolutely useless.

Box 4.28. The useless cistern toilets project provokes frustration

*'The [toilet] issue is dead, dead...people just don't want this issue to be mentioned...they are so desperate about this issue... they paid for the construction of new toilets and this fucking piece of shit (chingadera) is not worth the money they put in.'* MI12 – Celestino (president of the parents committee)

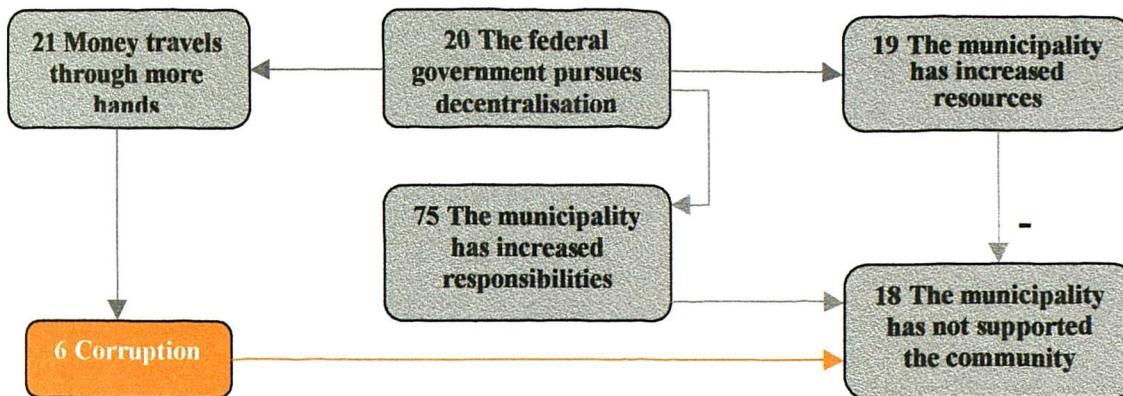




'Morelos' primary school  
The El Mirador case study:  
Sub-map 4

## 5. Sub-map 4

### 5.1. Concepts 6, 18, 19, 20, 21, 75



**20:** c.f. concept 66 section 2.4.

**6:** c.f. concept 69 section 2.7

**20→21:** The process of decentralisation involves the redistribution of power and resource management to state and municipal governments. Subsequently, the federal resources travel through the hands of more official intermediaries than under the old centralised regime.

**21→6:** The fact that federal funds are channelled through more hands before reaching the citizens increases the potential for corruption. Decentralisation brings more intermediaries who want a slice of the cake.

**6→18:** Corruption at all levels of power from the federal to the municipal authorities affects the support that El Mirador can expect from the municipality Santa Cruz Xoxocotlan. The distribution of resources amongst all municipalities and communities is generally subject to political influences. In this context, the municipal authorities disregard El Mirador, which is divided politically. Moreover, generally speaking, the small and distant settlements such as El Mirador tend to be neglected whereas more money is allocated to the zone around the town hall.

**18:** Since its creation, El Mirador has received little support from the municipality.



Box 4.29. Decentralisation and resources allocation

*'The municipality prioritises the communities located at the centre, whereas the settlements on the periphery are those that require more attention. You need to understand that all the money does not arrive at its destination, there is a lot of corruption at every level. The federal power allocates money for education and only a part of it reaches the state offices and the municipalities. Then the state sends the municipalities only a part of it, and so on until it finally reaches the localities.'* MI33- Cristian (teacher, business student and hotel employee)

*'This is a matter of being organised. All of this [the corruption] happens because of a lack of control. [...] In Xoxocotlan, they have a problem that has still not been cleared: the audit of the previous municipal government [shows that] there is deviation of resources. Thus, with financial malpractice, the people start to mistrust [the government]'* MI7 - Delegate of the State Govt

**20→19:** Decentralisation of the State leads to an increase in the municipal budget.

**19→18:** Theoretically, this increment in the municipal budget should lead to a better allocation of the public resources. The municipal power is supposed to have a better knowledge of the local realities and so can define the priorities for its jurisdiction. This happens to a certain extent but it is limited by the relationships **21→6** and **6→18**.

**20→75:** Decentralisation also involves more responsibilities for the municipality. For instance, some aspects of education or water and wastewater management are transferred to the municipal power.

**75→18:** However, the capacity of the municipal governments to cope with new tasks is often limited. The combined transfer of funds and responsibilities to the local governments was not accompanied by a transfer of technical skills. The capabilities of the municipalities have not been upgraded to meet the new duties imposed by decentralisation. As a result, the municipalities, such as Santa Cruz Xoxocotlan, often fail to carry out efficiently the tasks previously undertaken by the state or federal authorities.

Box 4.30. Decentralisation: resources and skill transfers

*In the state of Oaxaca, as in other poor states of Mexico, the level of education is much lower than in the centre and North of the country and it is quite common to see mayors that have hardly finished the primary school. In numerous cases, the low capacity of the municipal government teams prevents the efficient management of increased public resources and extended responsibilities.* MR6 - Municipality of S.C. Xoxocotlan



*'We understand that the government of Fox (Vicente Fox, the new president of Mexico) will pass to the states [...] the responsibility to manage the concession waters. But it is not enough to transfer the responsibility and the resources [...] but the people with knowledge, this is what is lacking and what is necessary... because they can send millions and millions of dollars and waste it: they have to invest now in the people. And these people should be encouraged to change things... [...] The municipalities have more and more money, but they do not know what to do with this money, because the congress transferred the resources to them, but it didn't give them information on how to use it.'* MI61 – J.Villalobos COPLADE (Federal Planning Department, Oaxaca)

*The decentralisation policy promoted during this last decade allocated more funds and autonomy to the municipalities. However, according to Maria del Carmen Salinas Sandoval (1997) cited in Velasco et al., 1999, 'the Municipality has not owned the necessary tools to make effective its economic and political autonomy. It proved very difficult for the Municipality to change the historic process that led to centralised policy, which determined a relation of subordination with respect to the other levels of governments'. MR6 - Municipality of S.C. Xoxocotlan*

## 5.2. Concepts 16, 22, 48



**76:** Mexico entered the North American Free Trade Agreements (N.A.F.T.A.) in 1994. It had a deep impact on the Mexican agriculture, severely affecting the peasants who lived on the culture of rain-fed maize and beans.

**76→48:** N.A.F.T.A. led millions of peasants from south Mexico to move alone or with their families to cities, northern states of Mexico, or to the U.S.A in search of employment. This fostered the rapid development of the southern peri-urban zone of Oaxaca City and of new communities mushrooming around El Mirador during the mid 90s.

**48:** c.f. concept 64 section 2.1.

**48→22:** El Mirador and the neighbouring communities are settlements that have mushroomed in the urbanisation context of the two last decades. Until the end of the seventies, El Mirador was nothing but cultivated land. In 1980, a few families bought the right to use some parcels, where they built their houses. More and more people kept coming from all the corners of the state. In the mid-80s, El Mirador consisted of about 80 people (MI6 - J. Bautista, 2000), then 682 inhabitants in 1995 (INEGI, 1995), and in 2000 the population was assumed to be around 1000 people.

**22:** Very few inhabitants of El Mirador originate from the neighbourhood. Most families came from remote parts of the state of Oaxaca to get closer to the city.

Box 4.31. The immigrants that founded El Mirador

*'We've spent 20 years here. We were the first. [...] Around here, on this side of the river, there was nothing. These were only ejidal lands (see glossary) and cultivated lands. This was very beautiful, all green. The peasants grew maize, peanuts, and beans. [...] There were two wells that got exhausted...During this time the level of water in the wells did not lower. The river was very clean, we used to bath there, the water was clean and crystalline. [Where the residential zone is now] there was alfalfa and maize, everything would grow there. [...] When we arrived, we were four houses, like a small farm. We came from Ejutla de Chrste, about 45 minutes from here. [...] It started to become more and more populated in 1985-86: other people came with all their families.'* MI6 –Juan Bautista, First community settler

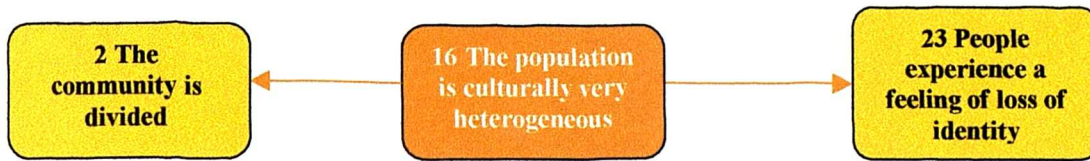
*'In this community, here, the people comes from the mountains, the people is...how do you say? ...cosmo...cosmopolite, they come from all the parts of the State [...] all the people have different customs.'* MI31 – Ernesto (teacher)

**22→16:** In El Mirador, as in the recent neighbouring settlements, the population mainly consists of immigrants from all the regions of Oaxaca, which is one of the Mexican states with the richest cultural diversity (i.e. 14 indigenous languages are still spoken in addition to the Spanish).

**16:** The population of El Mirador presents an heterogeneous cultural mix with distinct indigenous languages, customs, and religions.



### 5.3. Concepts 2, 16, 23



**16:** c.f. section 5.2.

**16→23:** For families leaving their remote villages which were ruled by traditions and customs, the experience of settling in El Mirador or in the neighbourhood is often shocking. People are suddenly projected, rootless, into a rich cultural melting pot, where they often develop a feeling of loss of identity.

**23:** Many of the people that migrated to El Mirador and the neighbourhood tend to experience this feeling of loss of identity. It takes a long time for the inhabitants to identify themselves with their new community, if they ever do.

#### Box 4.32. Cultural diversity and community integration

*'If you come from a place where people are not used to give tequio, where people speak another language (because there are 16 indigenous language). If you come with other customs and others habits, the integration process is slow...until only a strong leadership, I repeat, replaces this. But if there is no strong leadership, this is a migrating population with problems of identity...and then when the political issue intervenes, the problem gets more complicated...in some places the religious issue intervenes, and this complicates the situation more.'* MI11 - Joel Cortez (Educational zone supervisor)

*'Yes, here there are a lot of Mixtecs [i.e. Pre-Hispanic ethnic group] and they have their customs, they study religion a lot, they have other habits, but when it is a public matter, they do work. They do not refuse when it is a matter of tequio or a co-operation. The thing is that they have a different religion. We are traditionally Catholics and the Mixtecs are Evangelists. We, from the Central Valleys (we are quite numerous in these communities), we are used to the tequios and other forms of co-operation that one has to give.'* MI6 - First community settler

**16→2:** The mix of different languages, traditions, and religions in El Mirador makes communication amongst the inhabitants more difficult, because neighbours are seen as foreigners with different habits and distinct perceptions of life. This cultural heterogeneity represent an obstacle to community unity (at least in the short and medium term).

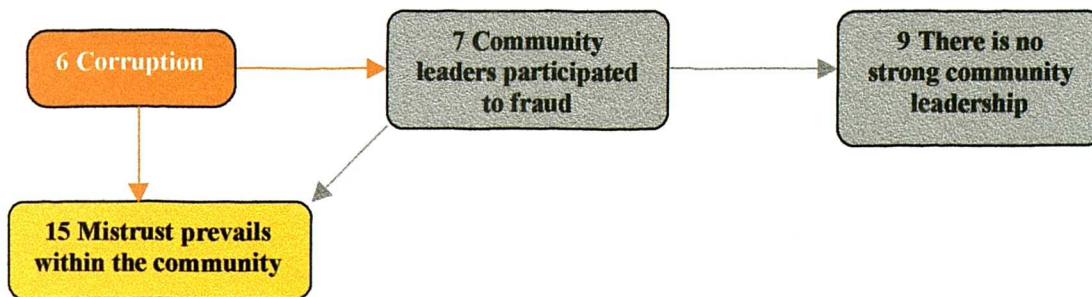


**2:** The community is strongly divided. For more than a decade there have been two rival groups. For several years El Mirador was governed by two distinct committees. Nowadays, although the community has apparently recovered its original unity, this division remains.

Box 4.33. Division in the community

*'We used to say 'those of Norberto' [the original leader of El Mirador] and 'those of Don Navor' [the dissident leader]. Now, apparently the community got united in 1997 but as the deep well issue surfaces again (c.f. Box 4.16. section 3.7), the toughest people, like Sergio and Ramon, who were much involved in the initial groups, reappear. Sergio Felipe was Norberto's secretary and he committed himself to end up with this spirit of division. The current committee is nonetheless exclusively composed of Norberto's men. They do not show a spirit of openness. MI2 – Elfego (community ex-president)*

5.4. Concepts 6, 7, 9, 15



**6:** c.f. concept 69 section 2.7.

**6→15:** Corruption is widespread in Mexico, and El Mirador is no exception. Indeed, the development of the community has been marked by a succession of frauds. This context of corruption and deception sustains distrust amongst the population

**15:** There is a feeling of mistrust amongst the population of El Mirador

**6→7:** In the Mexican context, where corruption almost appears to be institutional, there is a great temptation for people to commit fraud as soon as they hold a position that confers some kind of power on them.

**7:** Throughout its history, the population of El Mirador has witnessed or suspected irregularities committed by its leaders. The first leader of the community was accused of corruption, notably through electricity billing and the purchase of land to build the



primary school. Later, the president of the community water committee was suspected of participating in a fraud that caused the failure of an expensive community well drilling project (c.f. Box 4.16. section 3.7). The school director accuses the ex-president of the community of corruption when he was president of the parents committee.

**7→15:** Though it is hard to confirm the exact truth of these rumours of fraud (there were no lawsuits), the feeling that corruption is recurrent in El Mirador and that community leaders were repeatedly involved reinforces the mistrust amongst the population.

#### Box 4.34. Mistrust and community leader corruption

*Sergio Felipe (the community leader) is a little bit mistrustful about the dry toilet project. Many people are connected to the sewer system and he cannot see any reason why people would prefer an alternative. He is also doubtful about the motivation of Odilon (health committee director) for the ecological toilets project. Odilon's father belongs to the sewer system committee and he feels that this could well hide something. MI3 –Felipe (community president)*

*'Norberto was the first president of the community. We all supported him. His first work was to bring the electricity. Then he found an agreement with Avelardo (in Animas Trujano) and made a deal to buy the parcel for the school. There is no proof, but many people assume that he had a special agreement for the price: the people paid too much. It actually cost 13 millions pesos and he said it cost 18 millions.[...] He then started to make money with the installation of the electricity: we the neighbours would pay for it: the bill would be divided among the neighbours and [we] started to co-operate. He also charged the new neighbours (community members) the same price (instead of dividing the total bill by the total number inhabitants).' MI2 – Elfego (community ex-president)*

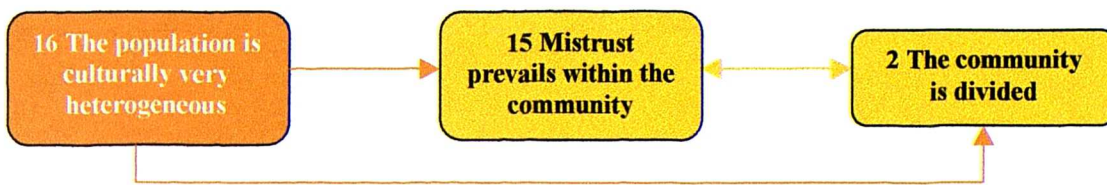
**7→9:** El Mirador developed quite fast during the first years under the authority of the community president Norberto. This leadership was later contested as rumours of corruption and personal enrichment spread mistrust within the community. This led ten years ago to the division of the community and the formation of two rival political factions.

**9:** During the last decade, the community failed to have a strong leadership capable of bringing the population together. Instead two opposing groups competed for power and control of the community.

**Box 4.35. Lack of strong leadership**

*Only about 50 people were at the community assembly, men and women equally represented. The committee proposed the creation of a group of police formed by a commandant, sub-commandant and co-ordinator, and staff members, to ensure security in the community. after a vote (20 votes for, 16 votes against) the committee organised the creation of that group, although one person repeated several times that this kind of important issue should be dealt with many more community members. I felt the president really wanted to proceed to this vote and to impose his idea, whatever the number of voting people, which was not very consistent with his commitment to unite the community. ME1 - Community assembly*

*'The people in the Sierra (the mountains of the state of Oaxaca) are more organised, because there is an authority, a law, a custom. Here it is tougher, there is no leadership, no order, there is no consensus. Over there, what is being said gets achieved, they punish those who don't follow the discipline.' MI34 - Benjamin (school director)*

**5.5. Concepts 2, 6, 15, 16**


**16, 16→2:** c.f. section 5.3.

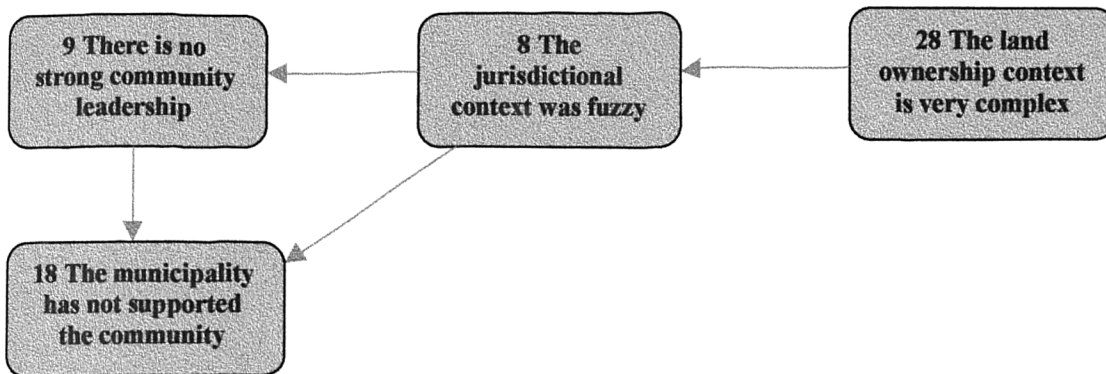
**2:** c.f. section 5.3.

**15:** c.f. section 5.4.

**16→15:** The fact that the inhabitants do not share a common culture, or observe the same customs and traditions sustains mistrust amongst the community.

**15↔2:** The general feeling of mistrust amongst the population favours division within the community. Likewise, the existence of two rival factions maintains the feeling of suspicion in El Mirador.

### 5.6. Concepts 8, 9, 18, 28



**9:** c.f. section 5.4.

**28:** The land where El Mirador mushroomed initially belonged to the municipality S.C. Xoxocotlan. The land ownership context became complex when, in 1970, a presidential decree granted the land to the ejido of Animas Trujano, as compensation for the lands seized by the federal government for the construction of the airport of Oaxaca City. The settlers of El Mirador had to buy the rights to use this land from the ejido of Animas Trujano. Then, they decided to change the status of their land to private property. Indeed, through the ejido system, the municipality of Animas Trujano (whose town hall is located several kilometres away) imposed excessive taxes on the people of El Mirador (taxes for the sewer system, the potable water network, and the village celebration, that the people did not use). Fifteen years of tedious and frustrating negotiations with the authorities of Animas Trujano finally led to the recognition of the lands of most community members as private property under the jurisdiction of Santa Cruz Xoxocotlan. The main difficulty was that the people of Animas Trujano were trying to make as much money as possible from the legal procedures.

**28→8:** The state authorities finally declared that the land of El Mirador had always been under the jurisdiction of Santa Cruz Xoxocotlan. But the people of El Mirador had reason to be confused because they received their voting cards from Animas Trujano and their primary school was supervised from an office in Animas Trujano. The statistical data collected by INEGI regarding El Mirador did not even appear in the 'Municipal Statistical Handbook of Santa Cruz Xoxocotlan of 1997' (INEGI 1997).

**8:** Until a few years ago, the jurisdictional context of El Mirador was fuzzy. While part of the population maintained that the community belonged to Animas Trujano, the others claimed that they had never ceased to be part of Santa Cruz Xoxocotlan.

**8→18:** The uncertainty regarding the jurisdictional status of El Mirador during the last 15 years has been detrimental to the community because it has not received much support from either municipality.

**18:** c.f. section 5.1.

Box 4.36. Fuzzy jurisdictional status restricts municipal support

*'This school used to belong to Animas and some people felt that the community should belong to Xoxocotlan because it is much closer. So the municipality of S.C.Xoxocotlan asked them why they remained with Animas'. Benjamin adds that Animas did not support the community: 'Animas never bothered about us. So the community opted for joining Xoxocotlan thinking that maybe they'd give us more support.' Another version of the story is that the two municipalities were from different political parties: 'Animas was from the PRI and when the community opted for Xoxocotlan, the municipality asked them to support the PRD.' MI36 - Benjamin (school director)*

*'There have been problems of boundaries: the school used to belong to Animas Trujano [...] but because of the remoteness of El Mirador, Animas abandoned the school. I went with the school director to the municipality of Animas to ask for some support, but they refused it to us, there were no resources. [...] There was no support from S.C.Xoxocotlan either, and the community was left abandoned.' MI28 - Juventino (teacher)*

**8→9:** The unclear jurisdictional context of El Mirador nurtured the division of the community into two political factions. The polarisation between Santa Cruz Xoxocotlan and Animas Trujano permitted the co-existence of two committees governing the same community.

**9→18:** The lack of strong leadership in El Mirador has had a detrimental effect on the support the community received from the municipality. The presence of an effective leader is often a requisite for a community to obtain the attention and the support of the municipal authorities.

Box 4.37. Lack of leadership and municipal support

*'There is a need for strong leadership from the president of the communities, who are the ones directly charged and responsible to impel the construction of pieces of work of public benefit: schools, roads, etc...If the community leader has a strong leadership and is*

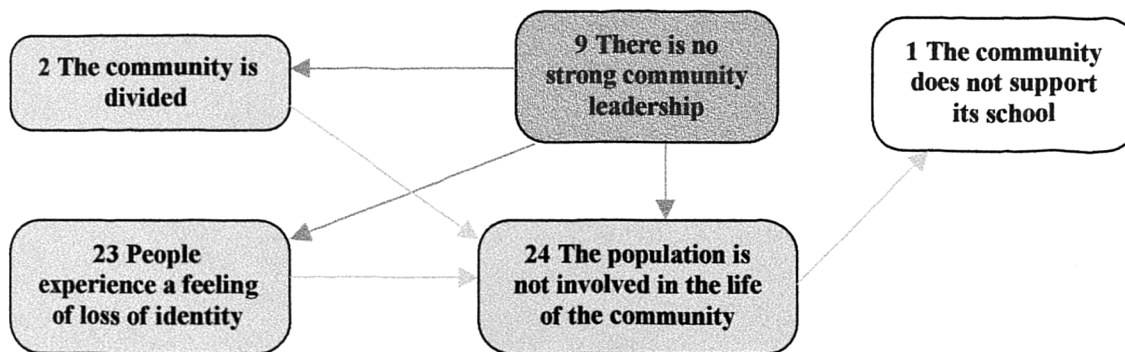


legitimated by the community, he can manage that. But the following phenomena occurs, where usually you don't have one but two or three leaders, and they fight for control [...]

All the state and municipal institutions [...] and each official have to support the localities in the same way, regardless of their affiliations. But this does not occur, this does not happen in the reality. The resources are channelled according to the connections and the existing inclinations. There is favouritism. There is the relationship with the authority, the leadership issue [...] There are communities very close to each other, and some progress more than others, depending on the leadership. In La Soledad, there is a very strong leadership: the leader has much support from the people and thus he can decide to support one party or another, but he maintains his leadership. Besides, if he wants to obtain something, as the state and municipal governments already know him, he can do this and that and ask for resources to channel to the school. And this also depends on the support he gets from the population, because this is also a problem.' MI11 - Educational zone supervisor

Benjamin observed that the school of La Soledad is four years younger than Morelos school but it already has proper classrooms. He adds that Lucio, the 'chief' of La Soledad is closely linked to the PRI and that 'there was much co-operation from the people because Lucio has imposed his authority and the way he leads the people is to say: 'We are going to do it because we are doing to do it!!'. MI36 - Benjamin (school director)

### 5.7. Concepts 1, 2, 9, 23, 24



9: c.f. section 5.4.

2: c.f. section 5.3.

9→2: Lack of strong leadership keeps the community divided.

9→23: A strong leadership can lessen people's cultural divergences, help them develop social bonds within their community and overcome the feeling of loss of identity by promoting community integration. Lack of effective leadership favours a continued feeling of loss of identity.

23: c.f. section 5.3.

**9→24:** A powerful leadership is a fundamental requisite for recent settlements, such as El Mirador. Indeed, an effective leader can gather the energy of the community members and require them to participate financially or by means of a tequio in common projects (construction of public infrastructure, improvement of school, health centre...). The lack of strong leadership in El Mirador results in the population's disinterest in community matters.

**24:** The population is hardly involved in the life of the community. A minority of people participate in the community assemblies, where important decisions are taken by a few men in the name of the whole community.

**2→24:** Since rumours of corruption and personal enrichment led 10 years ago to the division of the community and the formation of two rival leader factions, the people have not managed to unite and participate in tasks of common interest. This division has had a very detrimental effect on the involvement of the population in the life of El Mirador.

**23→24:** It can take a long time before immigrants really start to settle, manage to overcome that feeling of loss of identity and start to partake in the creation of a community life. In El Mirador, the participation of the people in community affairs is extremely low. Many people expressed their lack of attachment to the village. It really seems as if the people are not concerned at all because they do not identify themselves with the community. (c.f. Box 4.32 section 5.3.)

**24→1:** The lack of involvement of the population in the community life is notable in the way people regard their school. Only a third of the pupils of Morelos school come from El Mirador. Most community members prefer to send their children to a better school elsewhere than to try to make things improve at Morelos school. The lack of support from the people for the school is symptomatic of the community division. The school construction project was undertaken by the leader Norberto at a time when dissidence had already come out. Hence, the school stood as a symbol of this division and many people did not feel concerned about it at all.

**1:** The community does not support Morelos school. The community leaders do not consider the requirements of the school. Most community members send their children to other schools.

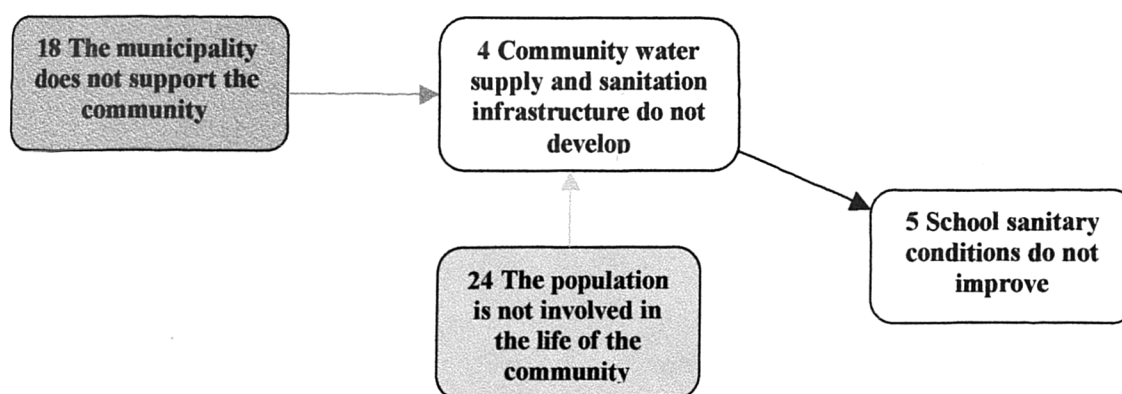
Box 4.38. Little involvement of the population in community life and school

*Maria's husband explained that the community committee has not been doing much for three years. Maria added that people are not involved in the community: when there is an assembly or a tequio, many do not come and they are not punished. They should be punished, she says, so that they participate. Maria and her husband say they come to every meeting. She said that the community is very bad, that nothing can be done, people are like children who do not listen at school, they hear the lessons but they do not learn anything. MI21 – Maria (community member)*

*'The real truth is that sometimes I feel disillusioned. I mean how? The population does not really get involved...we need more. Paraiso community, for instance, they wanted their school: they demonstrated in front of the state government building with the parents and their children... they eventually got their school built...' MI30 – Felicitas (teacher)*

*'The ones who should take care of the school are the ones who live here. [...] The people from the [community] committee have little motivation to improve their school'. MI18 – Elisabeta.*

5.8. Concepts 4, 5, 18, 24



**18:** c.f. section 5.1.

**4:** c.f. section 3.6.

**24:** c.f. section 5.7.

**18→4:** Lack of support from the municipality hinders the development of water supply and sanitation infrastructures in El Mirador.

**24→4:** Lack of involvement of the population in the life of the community negatively affects the development of public water supply and sanitation infrastructures. The lack of participation of the people in the assemblies and their disinterest in local politics

hinder the development of water supply and sanitation projects for the whole community.

4→5: c.f. section 3.7.

5: c.f. section 2.2.

Box 4.39. Development of the infrastructure requires population involvement

*'And the issue of the school El Mirador is part of this problem: these are new settlements, these are people who aren't from the municipality, these are people who came from outside, hence these are new settlements, it is a relatively young community [...] Another issue is the land. [The person who sold the land to the immigrants often] doesn't worry about sanitation, he sells, he hasn't got even a map, he sells, and later on the public authorities will have to intervene to bring the electricity, see the possibility of [installing] the sewer system, ...very slowly. Those who design [the size and arrangement of] the parcels are primarily interested in the money, and obtaining the public services and infrastructures will be the task of the inhabitants themselves, which will require community co-operation ...' MI11 - Educational zone supervisor*

*'[El Mirador] started to get populated very fast 12-13 years ago. The community was developing fast, thanks to the management of Norberto. [We were about to get] potable water, a sewer system...if we had not had these problems [political division], we would have all the public infrastructure. But the community doesn't work anymore.' MI6 - First community settler*

*A woman expressed her discontent with all the people that did not contribute to the drilling of the deep well: they should pay for the continuance of the work, she observed, or they should never have access to the potable water supply network. ME1 - Community assembly*



## **6. Conclusion**

The deficient sanitation development in Morelos primary school is strongly related to the lack of involvement of the population in the community and the lack of participation of the parents in the school.

Recurring frauds committed by local leaders provoked mistrust among the population and the division of the community into two rival factions. The fuzzy jurisdictional status of El Mirador has sustained this conflict. This caused inefficient government and the disinterest of the population in the community affairs during the 90s. Corruption, lack of unity, and the fuzziness of the jurisdictional status have restricted municipality support and led to the failure of a water supply project. The cultural heterogeneity resulting from immigration contributes to a feeling of loss of identity in the population. This feeling is maintained by a lack of strong leadership. Most people do not feel proud of their village and they are not concerned about the community primary school. Most pupils' parents live in the neighbourhood of El Mirador and do not want to contribute to the development of a school which is not theirs.

The socio-demographic context of El Mirador has much influence on the lack of sanitation development in the Morelos primary school. People who settle in El Mirador and the neighbourhood are poor immigrants coming from different parts of Oaxaca state. Their life is socially and economically difficult, as they find themselves uprooted in a very heterogeneous cultural environment. Poverty, marginalisation, recurrent frauds amongst the school parents committee, the irresponsible attitude of some teachers, and the lack of authority of the school's director affect the participation of the parents in the enhancement of the school.

Lack of political continuity results in short-term planning. In El Mirador, the primary school was designed and built without making any provision for population growth in the area. Now the state authorities cannot cope with the massive demand for education facilities consecutive to the explosive demographic growth in the region. Short-term planning also prevents integrated water and wastewater management. On the contrary, peri-urban municipalities solve their problems independently. Cistern toilet-sewer, the 'flush and forget' sanitation approach, is by far the preferred, and often the only

considered option. In Morelos school, this led to an acute incongruity: six cistern toilets were built although there is no water to flush them and no access to a sewer system. The municipal authorities lead the community leader to believe that a sewer project is feasible, but they actually support on-site ecological sanitation, an alternative solution. The community leader exclusively contemplates the sewer option and the municipality's two-faced attitude prevents sanitation development in El Mirador.

## C. The San Luis Beltran case study

### **1. Introduction**

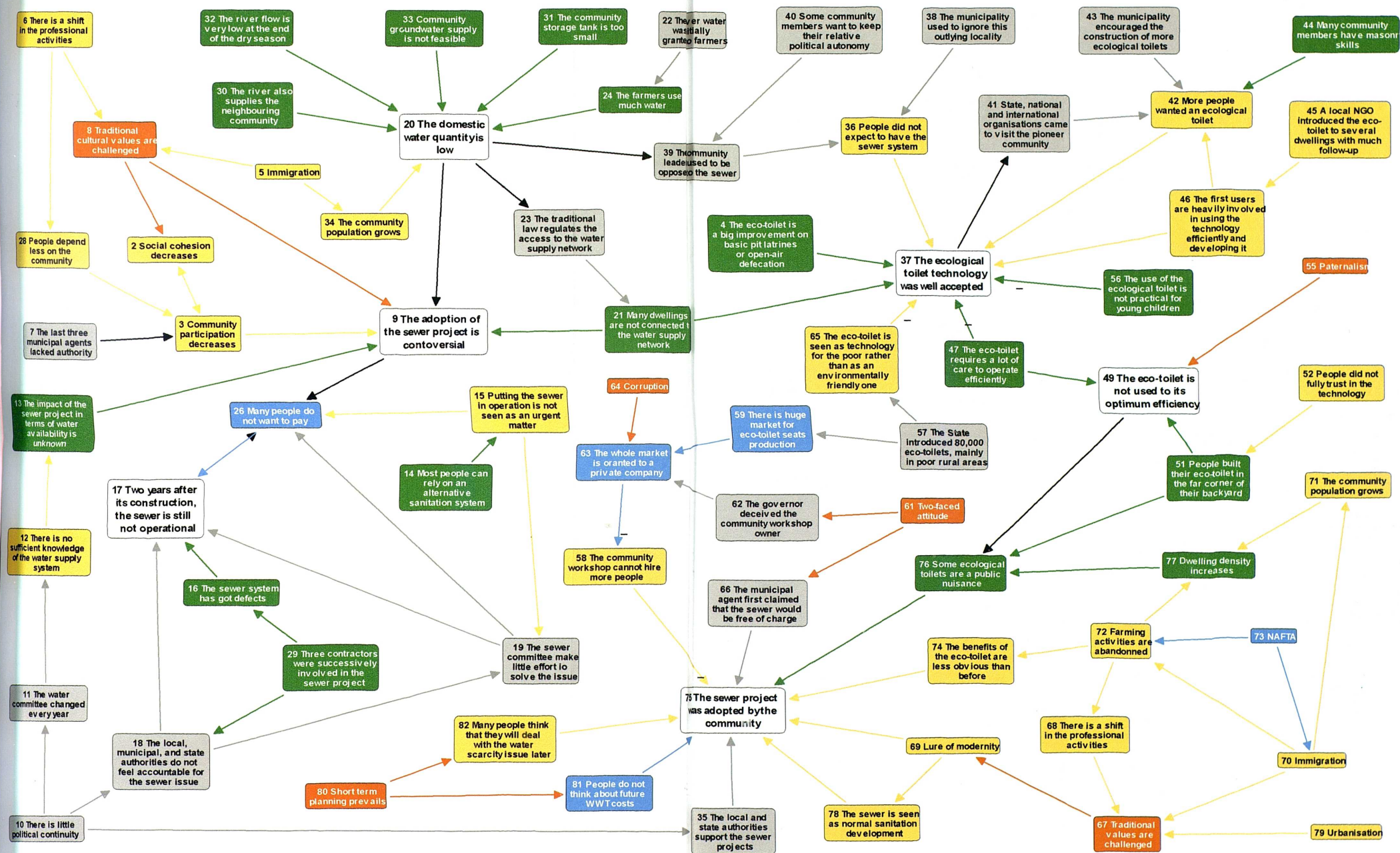
The results presented in this section are the product of the investigation carried out in San Luis Beltran between October 2000 and January 2001.

San Luis Beltran is a rural community of about 1200 inhabitants located on the edge of the peri-urban zone of Oaxaca City, Oaxaca state, South Mexico. Until the 70s, most of the population was involved in agriculture. The traditional laws and customs inherited from the Pre-Hispanic period shaped the local culture and organised the community life.

San Luis Beltran shares a gravity water supply system with the neighbouring community. The amount of water supplied to the population depends very much on climatic conditions and water shortages often occur at the end of the dry season. Because the community leaders were concerned about water scarcity issues and wanted San Luis Beltran to remain politically autonomous from the municipality, they kept on rejecting sewer system projects during the 80s and 90s.

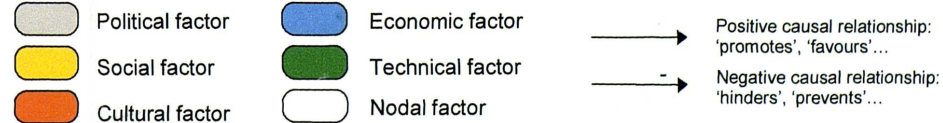
In the early 90s, a local NGO encouraged 25 members of the community to build ecological toilets. The good results achieved by this pioneer group led to the adoption of this on-site dry sanitation technology by most inhabitants in the following years. San Luis Beltran soon became a model in terms of sanitation management for the state, national authorities, and caught the attention of national and international donor organisations. As a result, between 1992 and 1998, the state authorities promoted the construction of 80 000 ecological toilets throughout Oaxaca state.

In 1999, the community voted for the construction of a sewer system. In January 2001, the sewer was still not operational and suffered from construction defects. The activity of the community workshop that produced ecological toilet seats and promoted this technology through the state was down to zero during the year 2000.

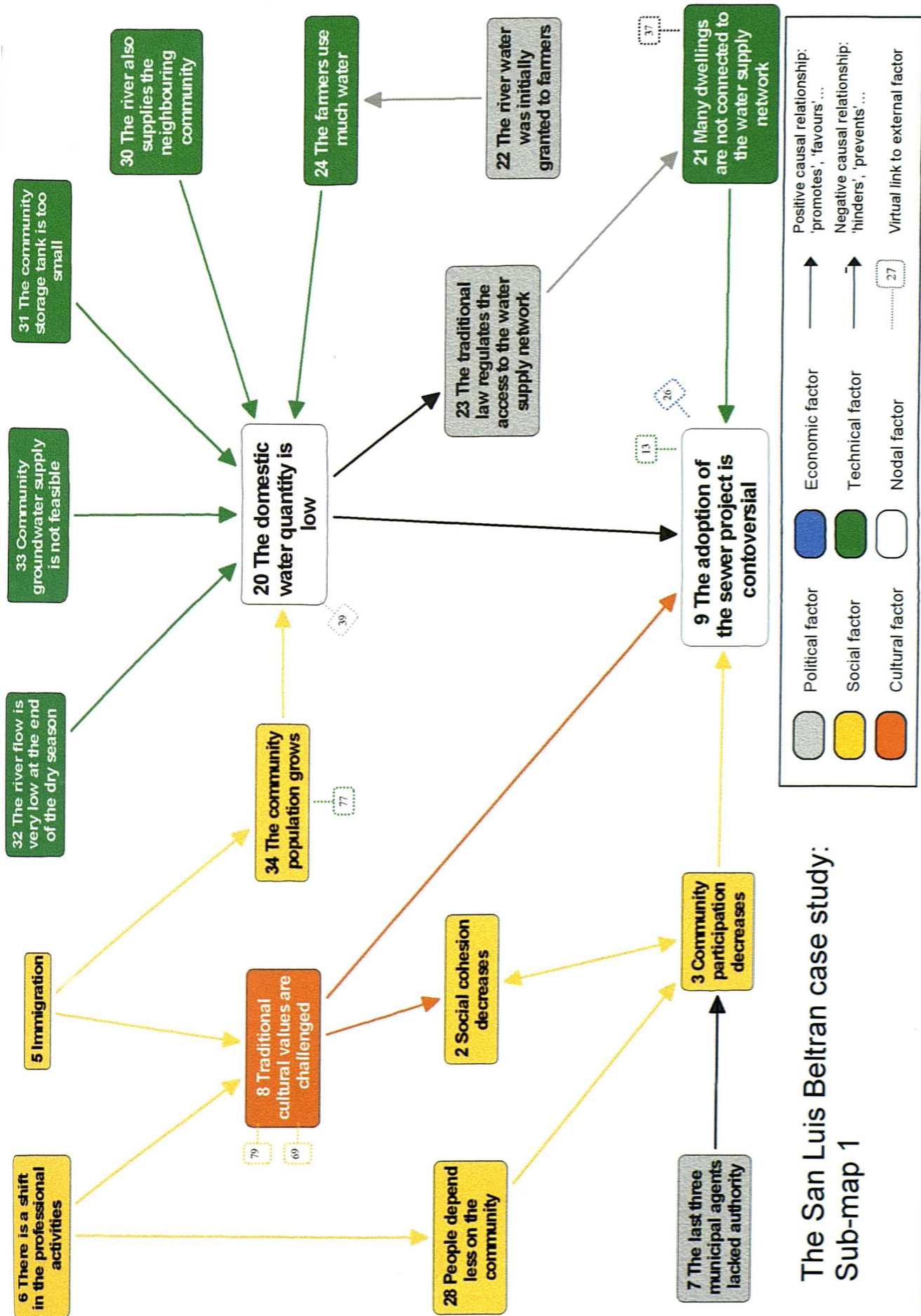


## The San Luis Beltran case study

### Overall map

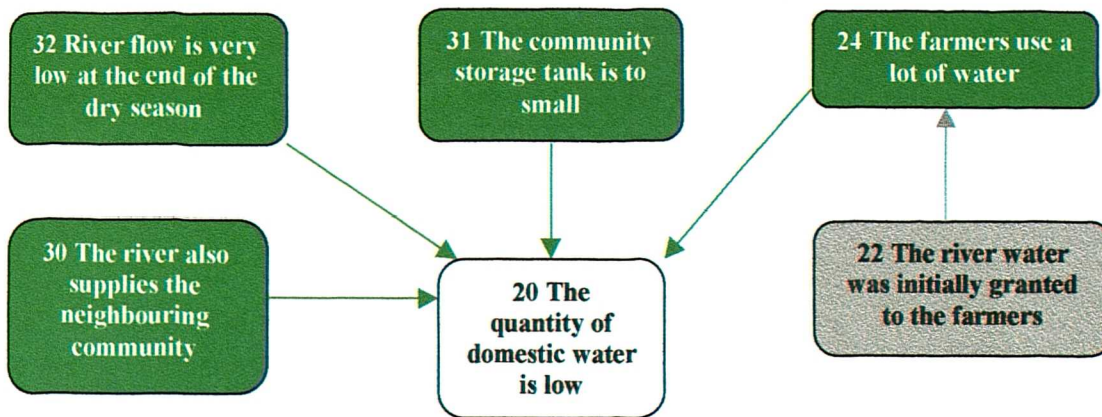






## 2. Sub-map 1

### 2.1. Concepts 20, 22, 24, 30, 31, 32



**32→20:** Water from the river Grande is brought by gravity to the adjacent communities Donaji and San Luis Beltran. The springs are fed by the surface and sub-surface rainfall runoff of small water catchments. Consequently the river flow varies during the year and depends much on the annual amount of precipitation. During the driest months of the year preceding the rainy season, water becomes scarce and its uneven distribution among the population occasionally leads to water shortages.

**20:** When compared to the rest of the metropolitan zone of Oaxaca city, San Luis Beltran enjoys favourable hydrological conditions. However, for many people, domestic water supply is a critical issue, in terms of quantity, especially at the end of the dry season.



**Box 4.40. The river Grande**
**Figure 4.14. The river Grande**


*The flow of the river Grande and the water flow within the distribution network had never been recorded prior to this project. Some measurements were taken during the period Nov.-Dec. 2000. The river flow was about 20L/s and the flow in the distribution network was around 12-13L/s, which corresponds to a potential volume of about 400L/c/d (Tiberghien, 2000).*

*Members of the local water committee estimate that the flow drops as low as 5L/s by the end of the dry season (that is: 165L/c/d). However, these figures just reflect the potential availability per person per day, without taking into account that many dwellings don't have tap water, some have a higher storing capacity than others, some waste quantities of water, while others only use a cubic metre of water for four people in three days.*

**30→20:** The river water was initially declared to be propriety of the ejido of San Luis Beltran. However, in 1929, the Republic president Lazaro Cardenas granted part of the water to the neighbouring locality Donaji. As a result, less than half the water entering the gravity water supply system is channelled to the population of San Luis Beltran.

**Box 4.41. Water scarcity**

*'Yes, it is true that there is little water, and that it gets scarce during the dry period, but here we are already well organised. During the dry period, everybody receives a given amount of water and we store it and take care of it. And logically, the person who takes care of his water has got enough of it, the person who doesn't, well....' SI15- Navidad & Serapio Acevedo*

*'There is not enough water. We did our best to build a tank, because it is not easy [financially speaking], but some people just have two or three oil containers... We receive the water from the network, but we are up the hill, and downhill they have guaranteed water. Two years ago, there was no more water. We had to buy water from cistern trucks, \$250-300 to fill our tank: this was a sacrifice for me! Thus, we thank God when we've got a trickle of water!' SI18- Señora Bautista*

*The perception of water issues varies a lot amongst the community dwellers, depending on their water supply source. People who do not have their own water outlet (they buy water or get it from their neighbour) and those who live in the highest part of the village are more aware of the situation, as they suffer more from water scarcity during the dry season. At the other end of the scale, those who don't live on the top of the village, and who have got their own tap and big storage tanks, do not experience water shortages for more than a couple of weeks per year.*



Figure 4.15. Domestic water reserve



*'We share the water with Donaji village [...], this community takes the water from 6am. They have it all day. We go up there to cut it in the afternoon at 5pm, so we have these small reservoirs at home to store water for domestic use... So they take it during the day, we get it at night, this is the way it is.'* S114-Manuel Acevado Luria

**31→20:** The 20m<sup>3</sup> water storage tank is too small. During a large part of the year water overflows the tank and discharges into a large basin used by farmers. The low storage capacity limits the availability of domestic water for the population.

**22→24:** Water from the river Grande was originally granted to the farmers for irrigation. More recently, the shrinking of farmland combined with the population growth resulted in the increase of domestic water use at the expense of agricultural use. However, some ejidatarios still have some parcels that they heavily irrigate with river water, to which they have priority access to.

**24→20:** The farmers' water uptake is quite important and reduces the amount of water available for domestic use. There is a conflict between water users. The farmers protect their interests and obstruct the connection of more water outlets to the water supply network.



**Box 4.42. Insufficient water storage capacity**
**Figure 4.16. Water storage tank**


*The tank is located at the top of the village with the river Grande water catchment in the background*

*'We plan to build a bigger water tank because the one we have now is about 30 000L, and we could have another one of 40-50 000L. It could supply more water outlets: some 25-50 people more. We need to do an analysis of all this issue. When the water is scarce, sometimes we only get water every four days for a month.'* SI1- Eleasar Sanchez (Ejidal commissioner)

**Box 4.43. Agricultural water use – Conflict between water users**
**Figure 4.17. Farmers' basin**

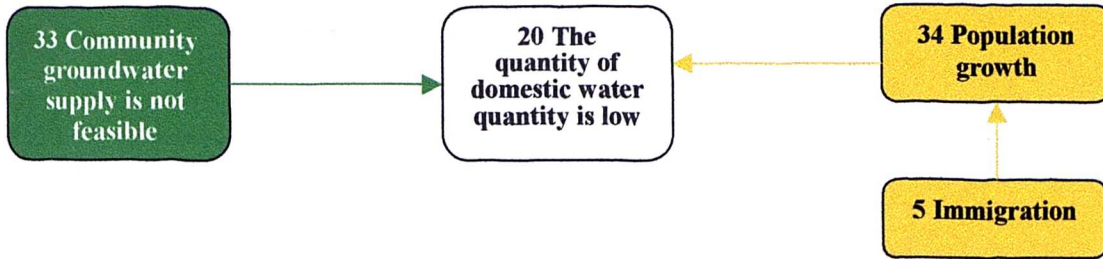

*The water is used by a handful of farmers who grow maize, beans and alfalfa*

*'About 5 years ago, people realised that some of the water leaving the sand-filter did not get into the water supply network. This was a political issue actually, because, it was convenient for the ejidatarios (the farmers) to keep water in the stream, as they use it for irrigation.'* SI6- Enrique Bautista

*'No, there is not enough water, after mid-December the river gets dry. During times of water scarcity, the sand- filter [operating at the inlet of the community water supply network] uses it all. This is one of the first things to say: farmers don't have animals any more to plough the land because there is nothing to feed them. The harvests aren't even enough to sustain a family. This is the economic situation we have...'* SI5- Eleasar Sanchez Mecinas



## 2.2. Concepts 5, 20, 33, 34



**20:** c.f. section 2.1.

**33→20:** The hydro-geological situation of San Luis Beltran does not permit groundwater extraction for community water supply.

### Box 4.44. Poor potential for community groundwater supply

*The municipality once carried out a hydro-geological study to investigate the possibility of using groundwater in addition to surface water for community water supply. The geologists deduced from their observations that there was no aquifer and no potential for significant groundwater exploitation. Only private wells with minor yield could be drilled where sub-surface water runoff occurred.*

*The opinion of Muñoz (National Water Commission, Oaxaca - groundwater area) confirms this assumption. He believes that the groundwater that can be found in San Luis Beltran merely corresponds to minor water flow through fractured rock. Some dwellings situated in the low part of the village or along the river on the east have private wells, usually 10-15m deep with yield varying from 500L/d to several cubic meters per day, according to their location. SR2- SLB Description*

**5:** During the last decade, a wave of immigrants came to settle in San Luis Beltran. These were either rich families leaving the city, attracted by the tranquillity of this village overlooking the city, or relatively poor families driven away from their isolated villages to the metropolitan zone of Oaxaca city, in search of higher wages.

**5→34:** The arrival of immigrants contributed to the growth of the population.

**34:** The population of San Luis Beltran continually increases. The native people fragment their parcels to enable their children to build homes in the village, and sell land to foreigners.

**34→20:** Population growth leads to a diminution of the volume of water potentially available per inhabitant.



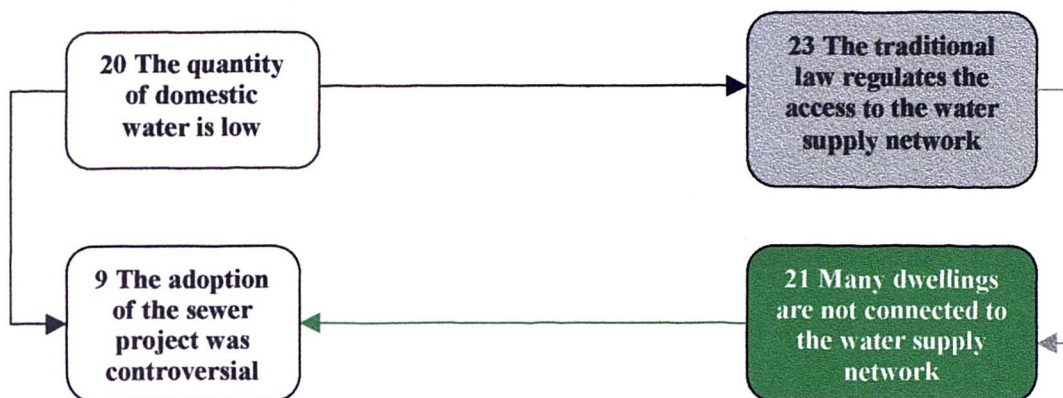
**Box 4.45. Population growth and domestic water availability**

*J: For what reasons may the water lack one day?*

*- 'There are more people every day, more outlets granted, the sewer will consume more, the climate is getting more extreme, the wood is burning.' (Señor Garcia, 40)*

*- 'Because during droughts the water gets really scarce, it doesn't come every day, there are more people coming, many houses, there is some fear that the water will become scarcer.' (Eddy Lopez, 24) SR3- SLB Survey*

*'For sure we'll have a problem: the population keeps on increasing while the water supply is limited'. SI6- Enrique Bautista*

**2.3. Concepts 9, 20, 21, 23, 25**


**20:** c.f. section 2.1.

**20→9:** The fact that domestic water supply is limited for many community dwellers made the adoption of the sewer system project controversial. People realised that introducing the sewer system would lead to a higher domestic water consumption in the whole of the village, which would inevitably exacerbate the water stress situation during the dry season.

**9:** The adoption of the sewer system was controversial. During the last fifteen years, the community presidents were opposed to the introduction of the sewer and preferred the alternative ecological toilet option. San Luis Beltran had then been labelled an 'environmental friendly community' by the local media. Three years ago the sewer project was presented to the community assembly, and although it had few supporters initially, the project was finally accepted after a tight vote.

#### Box 4.46. Sewer project controversy

*'Yes, they've wanted to put in a sewer for a long time. But [we said:] 'why do we want a sewer, if we already have ecological toilets. And now the time of water scarcity will come, and the sewer is almost useless without water.' In contrast, the ecological toilets don't use water, they just require a little bit of soil, you add some lime and ashes, and they work, while these cistern toilets, without water, well...' SI12- Geronimo Perez No.3'*

*'About 40% of the voters were against the project, but there were more votes in favour, so it was accepted. Even after the vote, people kept on expressing their disapproval: during the construction, we had difficulties crossing some people's parcels, which strengthened their opposition.' SI6- Enrique Bautista (sewer committee)*

*'The government saw that this village, which is very close to the city, [...] well, this village so close to the city is so marginalised, there are no communication roads, there is nothing [...] There were two or three assemblies, and it got accepted. It is not that everybody agreed but well, the government was offering the materials'. SI15- Navidad & Serapio Acevedo*

*There was no assembly where it was accepted, the president decided. I came to an assembly, but I was the only one from my street, my husband was not there and the neighbours neither. I opposed to the sewer, but they did not consider me, as I was alone...the neighbour disagree as well. I'm not going to contribute. They say we have to contribute. [...] Francisco Pacheco (community leader at that time) used to do things in his own way, he did not take the people into account.' SI18- Señora Bautista*

**20→23:** Domestic water supply in San Luis Beltran is limited. This led the local authorities to regulate its management.

**23:** In many localities in Oaxaca state, traditional laws are still effective and take precedence over municipal laws. In San Luis Beltran, the municipality does not deal with the water management, which is regulated by a local water committee applying the traditional laws. For instance, for the people who are not ejidatarios, access to the water supply network requires ten years of service for the benefit of the community.

#### Box 4.47. Regulation of access to the water supply network

*'E: Around 120 dwellings [have access to the water network], and there are about 265 dwellings in the village. All the ejidatarios have water, because the water belongs to the ejido. But all the others get water in one way or another. For instance, I give water to my two sons. And many people on the eastern side and on the south of the village have private wells.*

*J: And what is the procedure to follow to get a water outlet connected to the network?*

*E: You have to write a request and send a copy to the municipal agent, the ejidal committee, the water committee and the electricity committee. They all check if you are ok, that is to say if you have paid all your electricity bills, water bills, and if you have participated in the tequios and met your duties for the village. Then there is an assembly where we decide if you can receive it or not.' SI1- Eleasar Sanchez No.2 (Ejidal commissioner)*



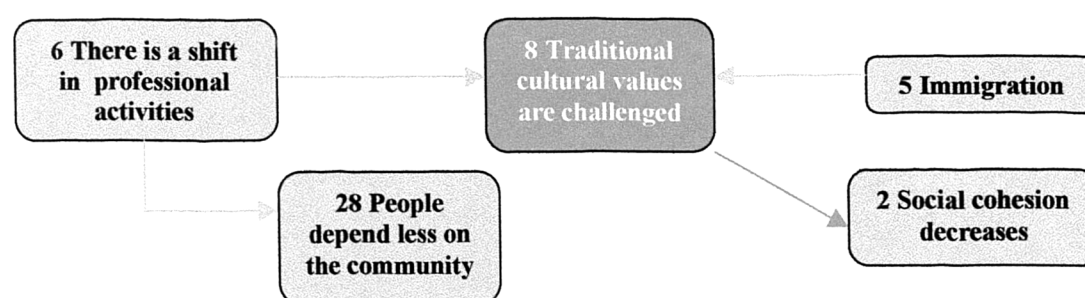
*'The people that came into the neighbourhood are not relatives, but commonly, these people have a certain economic power [...] They build large water tanks that they fill with water that they buy from the cistern trucks. Because there is a regulation here in San Luis Beltran: after some ten years, when a person demonstrates that he carries out his duties for the community, [...] he can obtain access to the water network...' SI8- Francisco Pacheco (Ex-community president)*

**23→21:** The process leading to the authorisation of a water outlet is based on merit, and is a long and tedious one. This 'regulating' system restricts the number of people that have a tap water at home.

**21:** Less than half the dwellings of the community are connected to the water supply network. Alternatively people get water from their neighbours or from a well (in a few locations only) or purchase it from cistern trucks.

**21→9:** Many of the people without access to the water supply network did not favour the introduction of the sewer system. Their motivations are numerous: they feel they will not benefit as much from the sewer as the people connected to the water network; they are satisfied with the ecological toilets; they do not have enough water to flush a cistern toilet; they purchase water from cistern trucks and use a cistern toilet/soak-away pit system...

#### 2.4. Concepts 5, 6, 8, 28



**6:** There is a shift in people's professional activities. While the past generations relied exclusively on farming to survive, now only a handful of farmers remain, most of them older than 40. The younger generations work increasingly in the city.

**6→28:** As people's lives shift from subsistence farming in San Luis Beltran to a wide array of jobs often outside the village, they become less dependent on the community. People used to rely on mutual help for some work in the fields but working in the city provides more independence. The average wage of the population has increased and people can buy what they cannot obtain from the village government (i.e. water, workforce).

**6→8:** The local culture was tightly bound to agriculture-the main activity of all the members of the community. The change in the professional activities of the population has a great impact on the traditional culture by bringing influences from urban society.

**5:** c.f. section 2.2.

**5→8:** Whether they are rich newcomers imposing other lifestyles or young adults coming back to their village after a few years of illegal work in the U.S.A., the immigrants bring new influences that challenge the traditional culture of the community.

#### Box 4.48. Professional diversification and cultural shift

*'And we have other problems coming from the immigration, right? They don't go to Mexico City, they go to USA and they bring other images, other life styles, and they want to implant it in their community [...] they even change the architecture, their lifestyle, the way they dress, everything.' SI4- Armando Ramirez*

*While some 30 years ago, there were probably only one or two religious groups in the community, San Luis Beltran now counts six different kinds of religion: Catholics, Evangelists, Baptists, Mormons, Light of the World Church, Jehova's Witnesses. Though this fragmentation of the population with regard to spiritual values does not directly affect the organisation of the village, this phenomena reflects a certain loss of traditional values common to the members of the community. SR2- SLB Description*

*Most men work as masons and brick layers (40-50%) locally or in the city, some 15% are truck drivers, about 10% are employees and there are only a few professionals with a high level of education (doctors, architects, accountants...). Very few men (5-10, usually old people), keep farming, growing beans and maize. Of course, one needs to mention the group of people that work in the USA, usually in farming, construction, or in catering. About 50% of the women work as domestics in the city, 10% are secretaries and a few work in shops. SI13- Luis Acevedo Mecinas (community treasurer)*

**8:** The traditional culture of the village is challenged. There is a kind of split between the people who want to stick to the ancient values (mainly the old people, but not

exclusively), and the younger generations, who bring in cultural elements from the city or the U.S.A.

**8→2:** The cultural split affects the social cohesion of the community.

**2:** As a result of the kinship among a large part of the inhabitants, the village has grown sharing a common pool of values based on family, Catholicism and farming... The system of customs and the involvement of all the citizens in the administration of the public affairs also contribute to the reinforcement of the social cohesion of the community. But nowadays, this social cohesion is being lost. The bonds that the native families had established between each other are loosening, as the younger generations spend less and less time in the village. Besides, newcomers do not integrate easily with the local people.

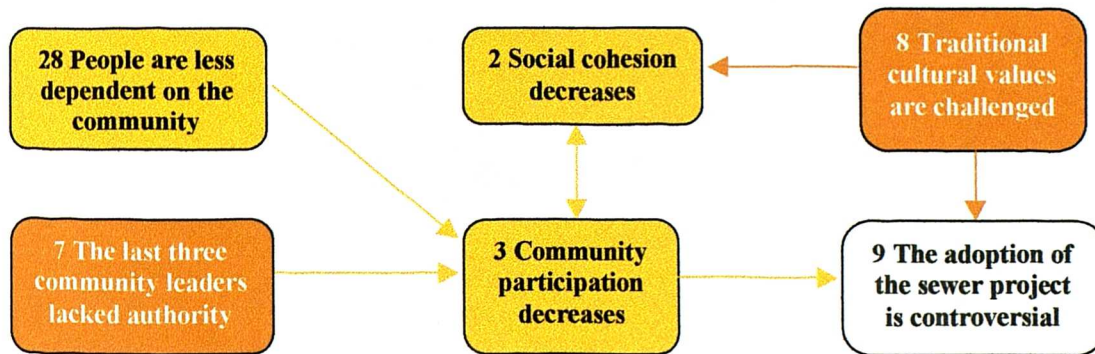
**Box 4.49. Loss of social cohesion**

*The 'non native' population complains much more about the lack of infrastructure than the native population, who are much more concerned about the loss of security due to gangs and the loss of community family atmosphere due to the arrival of newcomers with different customs. SR3-*

*'It is more quiet, there is more vegetation, but the neighbour's animals (pigs) stinks, and there shouldn't be such animals in this village. It is not a village any more!' (Celina Mecinas, 58)*

*'I like the tranquillity of the village, there is no danger. I don't like the newcomers and there are people who commit robberies but we can't say who they are.' Maira Gutierrez Lopez - SLB Survey Database*

## 2.5. Concepts 2, 3, 7, 9, 28



9: c.f. section 2.3.

8, 2 and 8→2: c.f. section 2.4.

28: c.f. section 2.4.

28→3: The fact that people interact less and less with the community affects their motivation and their capacity (in terms of availability) to participate in the village life.

7→3: The authority, involvement, and efficiency of the three last community leaders were insufficient. This laxity affected the degree of participation of the community members to local affairs.

3: The traditional laws and customs of San Luis Beltran effectively promoted different forms of citizen participation. During the last decade, this participative structure has lost its weight and many traditional institutions are disintegrating. People get less and less involved in the life of the community.

3→2: The traditional participative organisation of San Luis Beltran promoted the involvement of the population in the local affairs and the spontaneous development of bonds amongst the community members. The decline of participation in the village thus leads to a progressive loss of social cohesion in the population. Conversely, lack of social bonds amongst the community members decreases their attachment to San Luis Beltran and their involvement in local affairs.

3→9: Lack of participation makes it more difficult for the community members to agree about future development of the village. In the case of the sewer project, the decision was ratified after a tight vote involving only part of the population. Many people were



not aware of and did not participate in all the meetings that preceded this vote. Some feel that this affair was manipulated by few people.

**8→9:** The cultural gap between some groups of the community (old vs. young generations, natives vs. newcomers) makes it tough to reach a consensus. The controversy surrounded to the adoption of the sewer system partly results from this lack of cultural cohesion. The 'pros' claim that the opponents of the project are old folks afraid to change their habits and unable to adapt to the natural modernisation of the village. This group stresses that many people do not want to keep San Luis Beltran as a quiet rural village, and that the sewer is a sign of people being lured by modernity, unconscious of the adverse environmental impact associated with these apparent improvements.

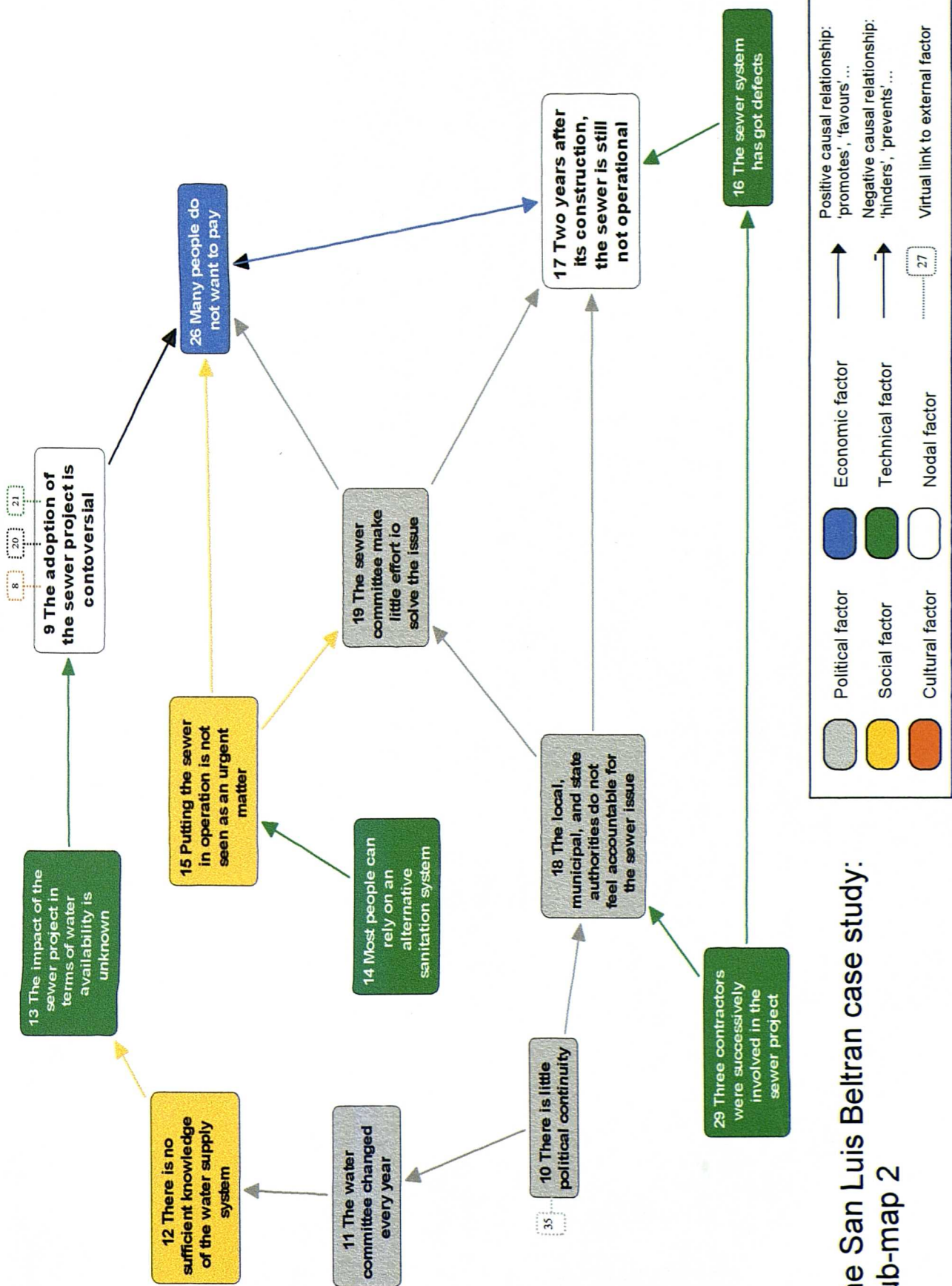
#### Box 4.50. Leadership and community participation

*The citizens have to fulfil many duties to deserve their rights. From the moment a man marries a woman, he is obliged to serve the community. This implies participation in the tequios, which are work of common interest (cleaning the streets, maintaining the sand filter, repairing a bridge...). One can either participate in the work physically or contribute. Additionally, each husband has to perform a public office for the sake of the community. The nature of the duty varies according to the age, experience, education and skills of the person. The lowest duty is the 'topil', a messenger who informs members of the community that the municipal agent or a given committee wants to see them. Policeman's duty involves a few hours per week looking after the village until midnight. To be member of a committee, representative of the pupils' parent association, secretary or treasurer of the municipal agent are duties too. The highest and final office one can have is the position of municipal agent. When one carries out this responsibility for three years, one is free from the system of charge but keeps on participating to the tequios.*

*Attendance at the general assemblies of the communities is also supposed to be obligatory. Ideally this should permit the community to develop in an homogeneous way by generating debates on critical issues and taking into consideration the opinion of all citizens. Failing to participate in tequios, assemblies, or to carry out duties legally can incur some form of punishment, which is ultimately decided by the municipal agent. For instance, the penalty can be a fine, some extra work or a few days in the local jail. SR2- SLB Description*

*'In the past the agency (the local government) was very active, there were more tequios, more people coming to the assemblies, and now only a few people come to the tequios, about 20%, and the others are not punished. In the assemblies (every 3-4 months) we barely meet the quorum. There have been three periods, that is nine years, when the activity of the agency has dropped, and nothing gets done. They got used to not promoting new ideas...the people are very indifferent. Not even 40% of the newcomers participate in the assemblies.'* SI13-Luis Acevedo Mecinas

*'The agent (community leader) that followed me twelve years ago did not have the authority to lead the people. He did not enforce the law, he did not want to create conflicts and preferred to develop friendships. The following one tried but he was too drastic, he did not have the charisma. I did not have any problems. I talked to the people and took the decisions with them. I demanded that people participate in the assemblies. There were no problems in the tequios...But they've let it [the organisation] collapse. This has been a disaster and this all originates from the highest level, the municipal agent. If he doesn't fine or punish people then now it is difficult, the people are indifferent.'* SI7- Eugenio Angeles Ramirez

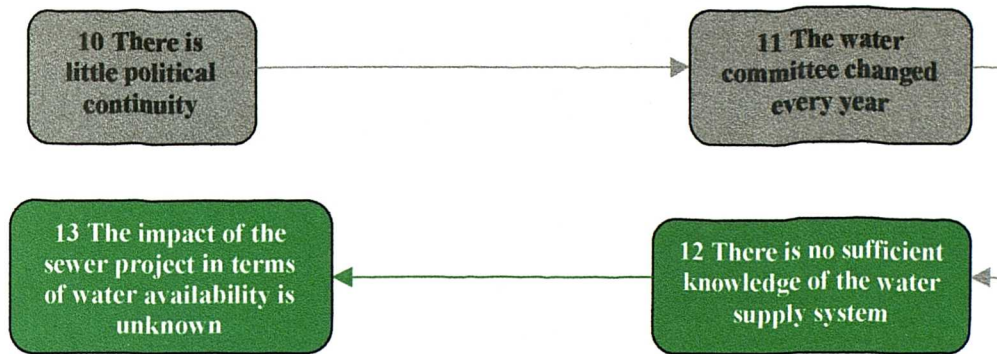


The San Luis Beltran case study:  
Sub-map 2



### 3. Sub-map 2

#### 3.1. Concepts 10, 11, 12, 13



**10:** There is little political continuity in Mexico. The politicians know that their task is very temporary as their mandate is short (especially at community and municipal level: three years) and successive terms of office are not permitted. Most of the people with managerial posts in municipal or local governments are replaced every three years. At the beginning of a new mandate, the government will tend to start everything from 'scratch' again, disregarding what the previous team accomplished. These observations also apply to San Luis Beltran, where the municipal agents (the community leaders) succeed one another without launching long-term projects.

**10→11:** This lack of continuity is clear in the work of the community water committee. The team used to be replaced every year, and it is only in 2000 that the authorities have decided to extend this period to three years.

**11→12:** This rapid turnover did not give much time for the members of the water committee to develop a global insight into water management in San Luis Beltran. The current president of the water committee did not even know the number of water outlets connected to the public water distribution network, until he finally discovered a map in a dusty corner of his office. Unfortunately, this map is not dated and it has not been updated. Besides, until November 2000, nobody in the village had an accurate idea of the water flow entering the potable water deposit, that is, the daily amount of water available for the community, which varies according to the seasons.



**12→13:** Coherent water and wastewater management requires long-term strategies based primarily on knowledge of the state of the natural resources. The sewer project has been implemented without knowing the precise characteristics of the community water supply system. There has been no simulation of the effects of the sewer system on domestic water consumption levels, which is crucial, considering the situation of water scarcity in San Luis Beltran.

Box 4.51. Lack of political continuity

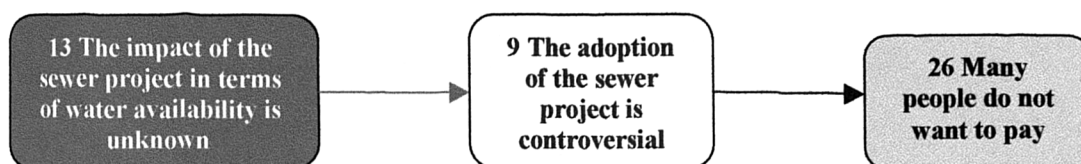
*'We, the people involved with the issues of the community, have various academic profiles, and this kind of unimlance. I work in the city [in a museum], the municipal agent that came before me is a mason, so this changes the perception. For instance, there was a small library, and the books were on the floor, so I installed shelves, and I asked a librarian to arrange the books in a proper way, in a more functional way, so that the community can get a real benefit. But it is obvious, a mason will tend to care for bags of cement, bags of lime and bricks, but not for books. The current municipal agent is a farmer, so he will be more likely to worry about the maize fields, the furrows...that kind of thing...So this is a reason why the form of development in the colony is not very even, not very homogeneous.'* SI8- Francisco Pacheco (ex-municipal agent, who was community leader during the introduction of the sewer system)

*It is true that the current agent who is a farmer, tends to protect, with the ejidal commissioner, the interests of the six ejidatarios (farmers) who continue irrigating their fields, sometimes wasting (or using in a very inefficient way) the high amount of water allocated to them. This affects a large part of the population that has not yet been authorised to connect to the water supply network. Likewise, Luis Agustin Bautista (ex-municipal agent) criticises Francisco Pacheco who introduced the sewer system in the community while several projects of on-site sanitation had already been implemented:*

*'But Francisco Pacheco, the municipal agent, he always tries to excel- I don't say it is bad, it is good-, but he [should] see the population projects with another insight, other projects, I don't know: chicken hen-houses, dressmaking workshops for the women, something different from what's been done before. If we already had a latrine program, well, don't put in a sewer! It is logical!'* SI2 – (Luis Augustin Bautista Lopez, community leader in 1990-92 during the introduction of the ecological toilets in San Luis Beltran.)

*One thing is clear: the sewer system was built under the mandate of Pacheco and is not in operation yet because of some construction defects. The sewer system committee that was appointed at the beginning of the project does not show any sign of willingness to solve the issue quickly. Pacheco doesn't live in the village any more and does not feel responsible for the issue: he relies on his successor to deal with the problem. But the current community leader does not want to deal with an issue that dates from the previous term of office.*

### 3.2. Concepts 9, 13, 26



**13:** c.f. section 2.1.

**9:** c.f. section 2.3.

**13→9:** Many people feel that the use of the sewer system might have major repercussions on water consumption habits and thus on community water supply. The lack of impact assessment contributed to the controversy that surrounded the adoption of the sewer project.

**9→26:** Many people refuse to pay for the sewer system because of the controversy about the project adoption. People wonder if there will be enough water to make the system run properly, if the authority will authorise its use, if it will ever be operational. Many community members seem to reject the idea that the project was voted on and accepted by a majority of citizens.

**26:** About half of the population does not want to contribute to the sewer system project.

#### Box 4.52. Will the sewer affect domestic water availability?

*According to Geronimo, when Mr. Arnault, the mayor of Oaxaca de Juarez (the municipality which San Luis Beltran depends on) came to inaugurate the street lighting, the community leader, Francisco Pacheco, told him that he had good news, that the village would soon have its own sewer system. Arnault did not look enthusiastic at all, and asked if the people had worked out the water supply issue. They replied that it was not a problem, that they had thought about it and that they would build a dam to store the water needed. Arnault then suggested that the dam be built before the sewer. S111- Geronimo Perez No.1&2*

*-Q: Do you think there will be enough water for the sewer and for the other domestic uses?*

*- 'Who knows? We haven't lacked water for three years. Maybe the water will be less with the use of the sewer. But most people think about keeping the ecological toilet for times of water scarcity. The cistern toilet is rather for the guests.' (Saul Melchior Acevedo, 25)*

*- 'Yes, because we've got an extra cistern that we use as a safety reservoir.' (Alicia Mecinas Rodriguez, 38)*

*- 'It's going to be a little bit difficult because there is little water, and logically, everybody will want the cistern toilet. That is when the problems will start.' (Argimino B. Reyes, 47)*

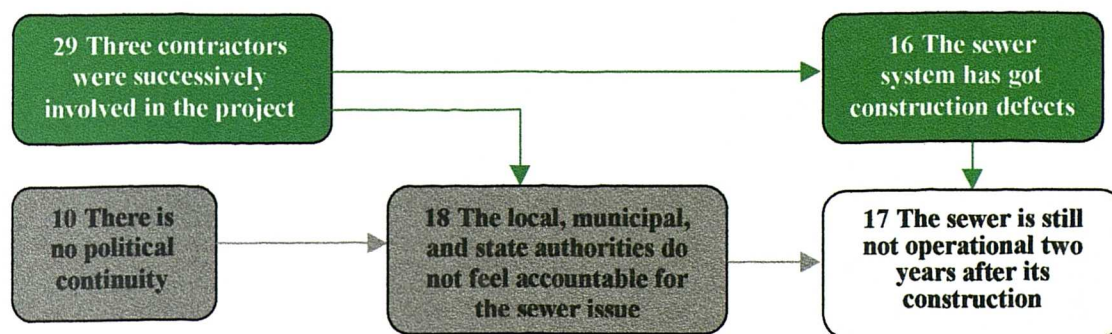


- 'I think that it's going to be difficult because there's little water. We share it with Donaji and we have to get up at night to get the water. We'll need a cistern.' (Eva Hernandez, 50)

- 'Yes, because it doesn't use more water.' (Mariano Gutierrez Bautista, 55)

15 interviewees (out of 50) believe that the use of the sewer system by the community will not affect the quantity of water available for their other domestic uses. They feel that there is enough water and that the consumption will not increase significantly. The five teenage interviewees share this optimism. 22 interviewees reckoned that the consumption of water is very likely to increase, which could lead to more critical water shortages than ever experienced before. SR3- SLB Survey

### 3.3. Concepts 16, 17, 18, 29



**29:** The state government financed the first part of the sewer system and the rest of the network was financed by the municipality. Municipal and state authorities thus brought money, civil engineers and the workforce into this project, and three different contractors took part throughout the duration of the project. That is to say, no institution was responsible for the design and the construction of the whole project.

**29→16:** The participation of three different contractors hired by two distinct bodies increased the likelihood of defects in the design and construction phase of the project.

**16→17:** The sewer system has several defects. They remain unfixed, which prevents the sewer system from being operational, two years after its construction.



**Box 4.53. Sewer system defects in San Luis Beltran**
**Figure 4.18. Introduction of the sewer system in Donaji**


*(Donaji is the neighbour community with similar topographical and hydrological characteristic to San Luis Beltran)*

*Series of defects in the sewer network*

*According to several dwellers, part of the sewage will get trapped in a pipe section and will eventually overflow the observation well and flood the street. In addition, many dwellings have no access to the sewer, either because the house is located far below the pipe level, or simply because the network does not serve their street. Besides, it seems that some rainwater already infiltrates into the network at the top of the village. Some interviewees also expressed doubts regarding the quality of the masonry work on the observation wells. The diameter of the sub-collector sewer pipe of the Jardin community, downhill, where the sewer networks of both communities connect, is too small. Furthermore, the pipe that connects San Luis Beltran network to Jardin network was laid in a gully, and the soil erosion protection which were built, were insufficient. Consequently, last summer, the soil covering the pipes was washed away, several pipes disconnected and some soil infiltrated and clogged the pipe.*

**29→18:** Two institutions and three distinct contractors have participated in the sewer project. This creates a lack of clarity regarding the scope of responsibility of each stakeholder in the project.

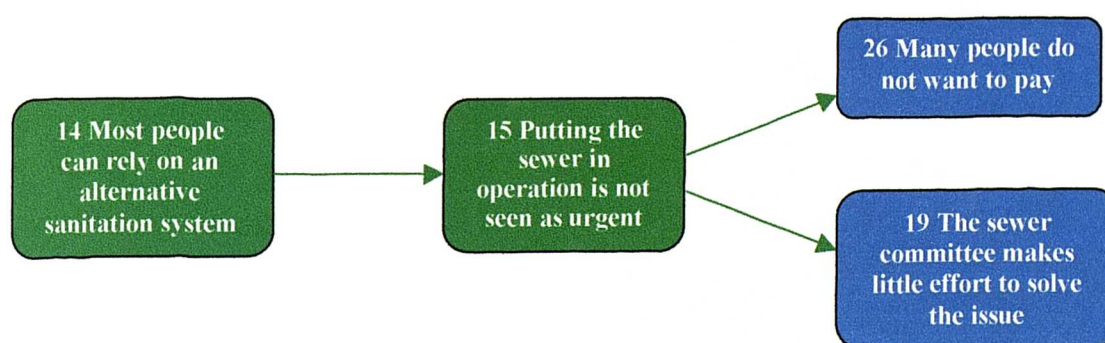
**10→18:** Lack of political continuity expresses itself by a certain lack of interest on the part of the new government in power with regards to what was undertaken by the previous government. The authorities do not feel accountable for on-going projects that were initiated during the previous term of office. As a result, the current local, municipal and state authorities do not show much willingness to complete the sewer project.



**18:** The local, municipal, and state authorities do not accept the responsibility for the whole project or for solving the defects in order to put the system into operation.

**18→17:** The lack of willingness of the municipal and state governments to complete a piece of work in which they both invested a great deal of money and time leads to a situation of inertia, where the project is almost completed but the system is still not operational.

### 3.4. Concepts 14, 15, 19, 26



**14→15:** Most people do not have an urgent need to use the sewer system as almost all the members of the community can rely on some other kind of sanitation system, ranging from simple pits, to improved pit latrines, ecological toilets and cistern toilets with septic pits.

#### Box 4.54. Sanitation facilities

*Q: Do you have a toilet, what kind?*

*- 'We have a cistern toilet for the kids and for us at night and an ecological toilet for the parents during the day, so we don't fill the pit too fast.' (Roberto Ruiz Lopez, 38)*

*- 'We have a cistern toilet with a septic tank followed by a septic pit. The sewer isn't necessary for me, but we have to pay.' (Celina Mecinas, 58) SR3- SLB Survey*

Table 4.1. Sanitation facilities in use

| Toilet type                                | Number (sample: 50 interviewees) |
|--------------------------------------------|----------------------------------|
| Cistern toilet (+ soakway or septic pit)   | 14                               |
| Ecological toilet                          | 22                               |
| Pit latrine (slab or urine diversion seat) | 12                               |

(SR3- SLB Survey)



**15→26:** Most people do not badly need to use the sewer. Consequently they have not considered the contribution to the sewer project as a priority.

**15→19:** The lack of urgency surrounding the completion of the sewer project does not encourage the sewer committee to deal with the issue seriously.

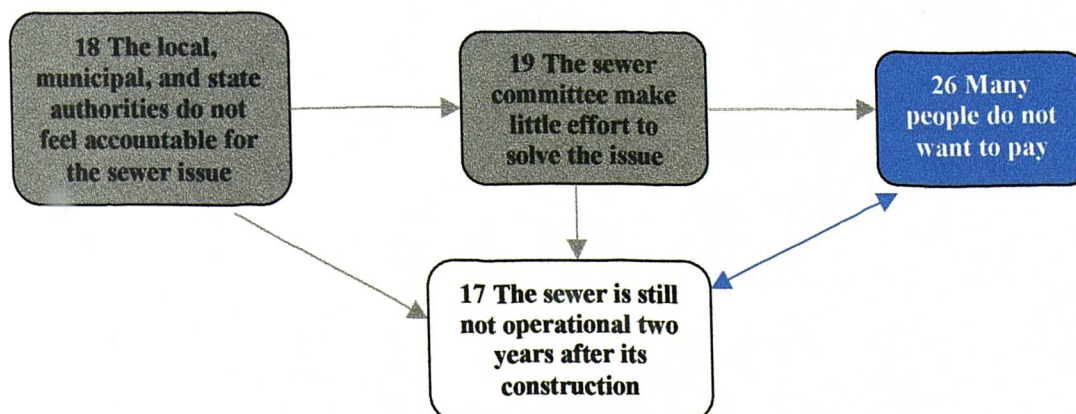
**19:** The community sewer committee does not express much enthusiasm about trying to solve the sewer issue.

**Box 4.55. Little progress from the sewer committee**

*The sewer committee is very lazy, they say it depends on ADOSAPACO (the municipal water operator organisation), on the municipality, they don't hold themselves responsible for the issue. Many people don't want to pay for the sewer, because they don't know where the money goes, there is no clarity. SI13- Luis Acevedo Mecinas*

*According to Rogelio Ruiz, a member of the sewer system committee, some defects in the construction seem to prevent the municipal water operator ADOSAPACO from validating the infrastructure, thus authorising people to be connected, and nothing can be done until all the beneficiaries pay. (Ruiz, 2000) The water committee doesn't express much enthusiasm about tackling this stagnant situation. Many members of the community feel that this committee are a 'bunch of lazy guys' who do not fulfil their duty. SR2- SLB Description*

**3.5. Concepts 17, 18, 19, 26**



**18,** and **18→17:** c.f. section 3.3.

**18→19:** As all the stakeholders in the sewer project accuse each other of responsibility for the project failure, the sewer committee is bewildered and reacts with a certain fatalism, by expressing little willingness to make things progress.

**19:** c.f. section 3.4.

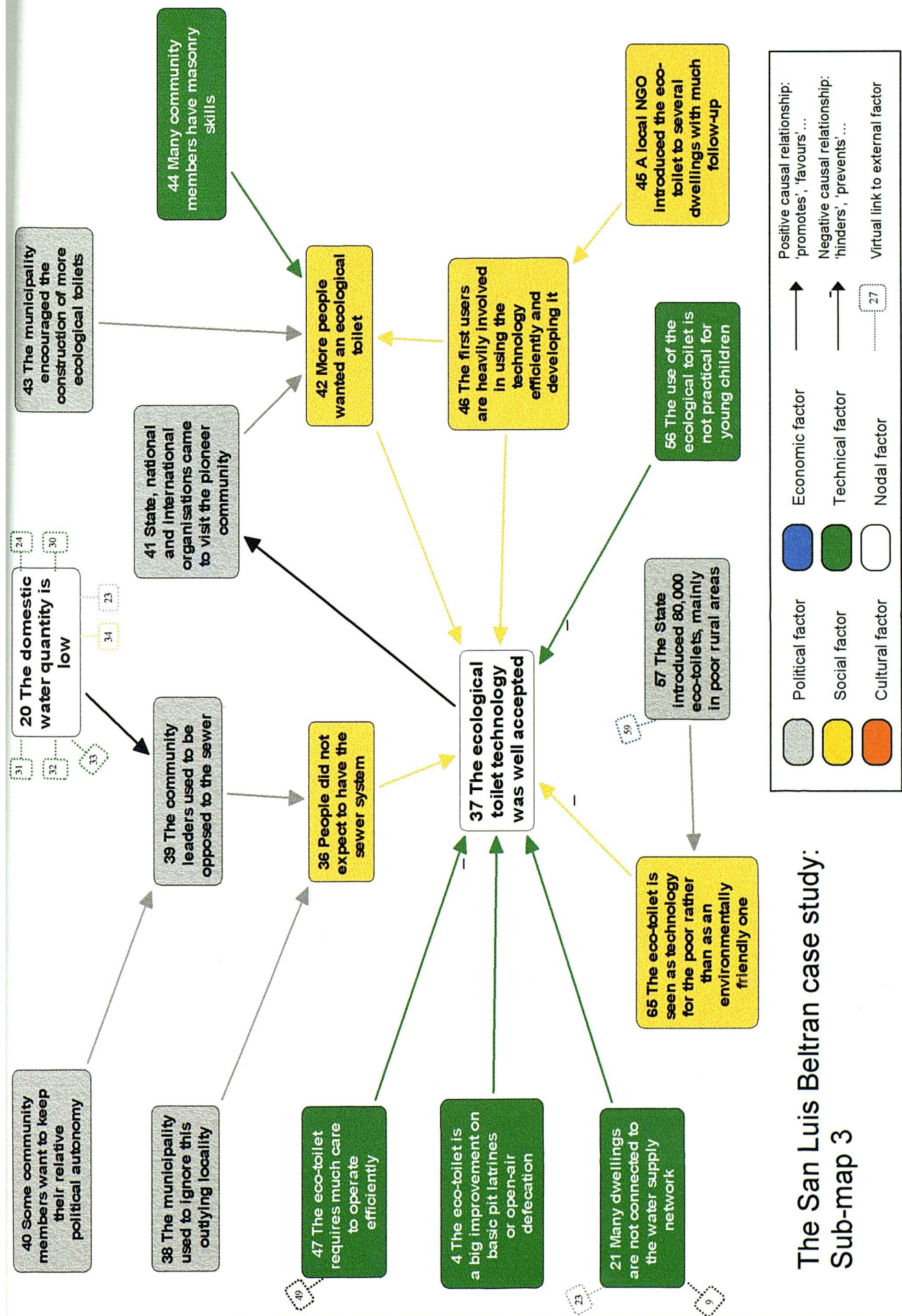
**19→17:** Lack of enthusiasm of the sewer committee to meet its responsibilities is stopping the rapid completion of the project.

**19→26:** The sewer committee does not put much pressure on the inhabitants and does not manage to persuade them to pay their share.

**26:** c.f. section 3.2.

**26↔17:** The municipality requires the beneficiaries to pay before they can fix the sewer system. By failing to pay, people contribute to the stagnation of the project. Conversely, many people are mistrustful and refuse to pay until they actually see the system in operation.



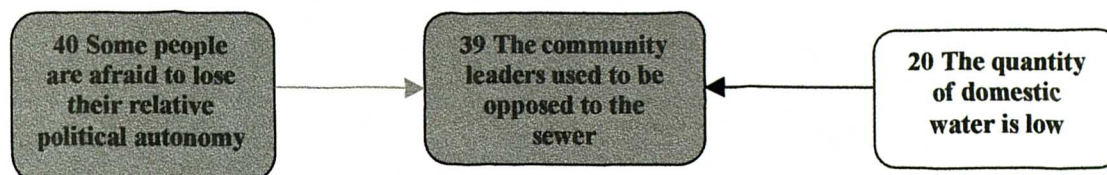


The San Luis Beltran case study:  
Sub-map 3



## 4. Sub-map 3

### 4.1. Concepts 20, 39, 40



**40:** Some people (mainly the older generations of the village) value highly the relative political autonomy of San Luis Beltran and want to maintain this state of independence. They perceive the introduction of the sewer system and other modern infrastructure as the expression of the wish of the municipal authorities to take control of San Luis Beltran by incorporating it as a common urban district under their jurisdiction.

**40→39:** The desire to keep San Luis Beltran relatively autonomous from the municipality led some members of the community to be mistrustful and opposed to modernisation projects in the village, such as the sewer project.

**39:** During the two last decades, community leaders generally expressed a negative opinion regarding the sewer system and opposed the construction of the sewer in the village, when state or municipal authorities suggested it.

**20:** c.f. section 2.1.

**20→39:** The leaders of San Luis Beltran were generally aware of the limited nature of the water supply and the likelihood of water scarcity crisis during the dry season. Consequently, they opposed the construction of the sewer, which would lead to higher water consumption.

#### Box 4.56. Community leaders reject sewer projects

*A: 'This was a municipal program for all the communities, and so they proposed the sewer. And I said: 'You know what? I don't want it. I don't want it because we don't have water.' Then, we got involved in the ecological toilets. And another municipal agent followed, the one after me, they [the municipal authorities] came again and they wanted him to introduce the sewer. To Andres Acevedo, the one after me. [...] They offered to build a potable water tank up there, put the program of potable water up there to get water [incorporate us into the municipal water supply network]. [...]*



*J: They were offering water in exchange for the right to carry the water across the village to San Felipe and to Donaji, right?*

*A: Exactly, and for all the communities down the hill. And we said no, because they wanted to contaminate our water, which comes from the hill and is clean. Thank God we have it. So they said: 'We connect the water to the tank we're going to make for you, and we'll give you water.' They were going to put in flow meters, they were going to incorporate us...?*

*J: Do you mean that they were going to make you dependent on ...the city.*

*A: Yes, on the city. So we refused...*

*J: They were offering both things: water and the sewer system.*

*A: Exactly. So I was one of the pioneers to see that. [...] We don't want the [their] water, we've got water to survive, we don't need the sewer, we've got latrines. We're happy like that [...] The other thing is that they said that if they put in the sewer here, they would pave the road over the sewer. I tell you that the government does things its way, but they don't tell the people about the benefits and the drawbacks. But we're guilty, the people who govern and the population, for not realising what the projects involves. Because I repeat: during the two terms of office previous to mine, they had offered the sewer system. And when they offered it to me, we refused for the same old reasons.*

*J: Why is there such a strong desire from the government to implement it?*

*A: It is to enclose us within the city. As municipal agencies and as villages, we've always opposed ourselves. But the government doesn't want us to remain a village, but a district.*

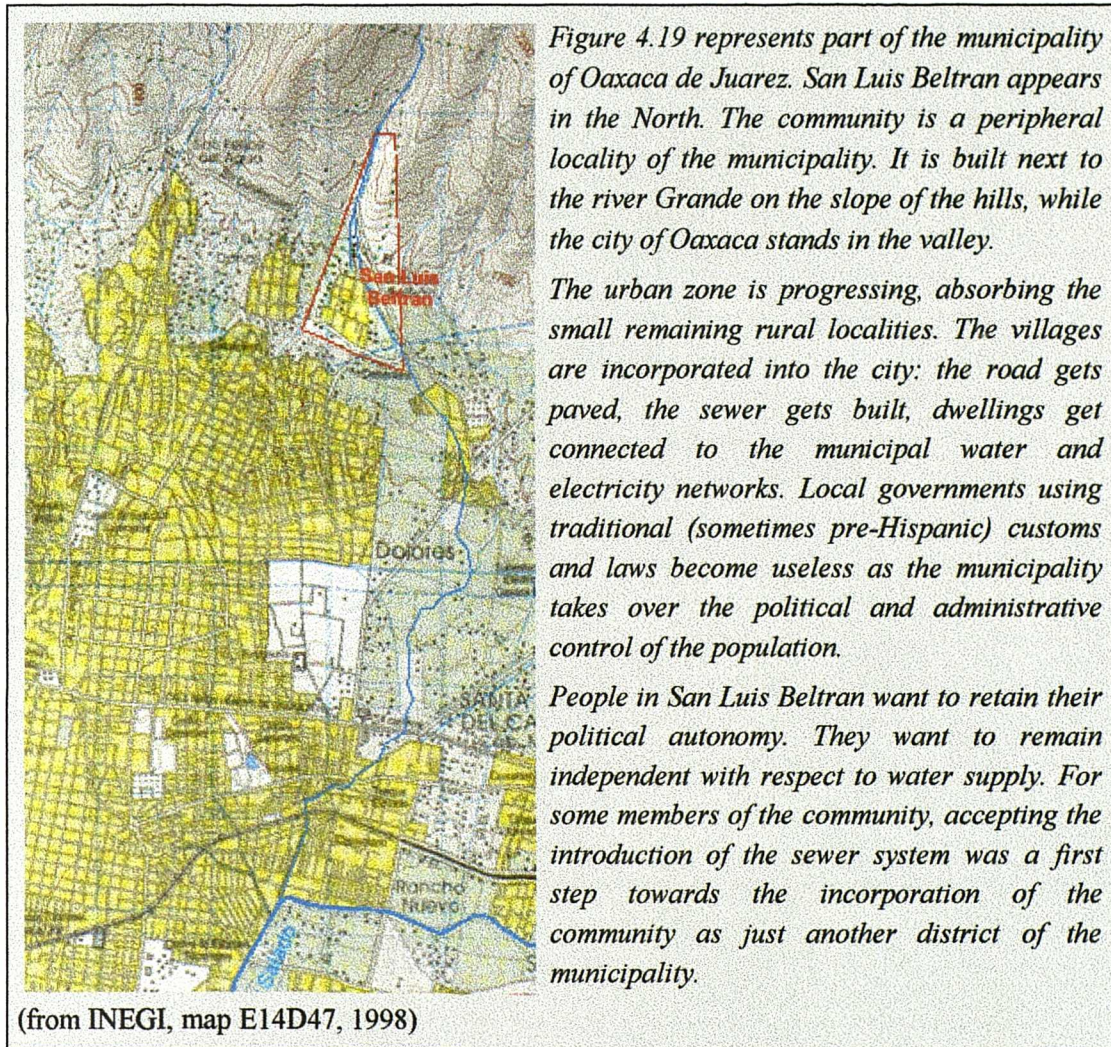
*J: That can be managed...*

*A: Exactly, this is what happened with Dolores: it was a municipal agency, and it is not anymore: it is a district now. It lost its independence. It lost it...*

*SI2- Agustin Bautista Lopez (community leader in 1990-1992)*



Figure 4.19. San Luis Beltran in Oaxaca de Juarez municipality





#### 4.2. Concepts 36, 37, 38, 39



**39:** c.f. section 4.1.

**38:** The development of San Luis Beltran has not been a priority for the municipality of Oaxaca de Juarez, which focused mainly on the urban zones, disregarding the small peripheral rural localities.

**38→36:** For many years, the community members could not expect access to a sewer system, since the community was not rich enough to build it and the municipality was offering too little support.

**39→36:** Since community leaders were opposed to the idea of a sewer system in San Luis Beltran, the community members did not expect to have access to this service in the medium term.

**36:** Community members did not expect to have a sewer system in San Luis Beltran, at least in the short term, mainly because it did not seem economically feasible and because of the water supply context.

**36→37:** Because people did not expect a sewer system to be built soon in the community, the ecological toilet system appeared to be a very opportune technology.

**37:** The ecological toilet was widely accepted by the population of San Luis Beltran when it was introduced by an NGO and supported by the municipal and state authorities in the early 90s.



**Box 4.57. The ecological toilet, an opportune technology for San Luis Beltran**

*'Then the people of San Luis Beltran got interested in it and they said: 'right, we'll do it, we are a group of 25 people, you just find the money...'. So in 1990, I think, we obtained the money to support them, then, in short time, a month or a month and a half, the 25 toilets were constructed. They were financed by the government. At that time, I realised that they were accepting the toilets because they knew that they would not get a sewer system, or that it would take a long time before they got it. This was an outlying locality, far from the centre, it was of little interest for the government, and so they would not give them this infrastructure. They would give them other things first, but the sewer system was very expensive. And they accepted this [the eco. toilets] while waiting for the sewer system, and this is the way I was told it by somebody from the community, he said: 'well this is good because in 3, 4 or 5 years when they install the sewer, we will have nice toilets, but until then we'll use this one.' The 25 toilets were obtained, built, and they started to use them. Then, the people formed a committee and started to manage more toilets, and they themselves obtained (we helped just a little bit, really), through their own efforts, finance for 140 ecological toilets. And they built them. SI20- Enrique Vignau, Espacitos (Alternative Technology NGO)*

**4.3. Concepts 37, 42, 45, 46**


**45:** In the late 80s, CITA (a Mexican NGO) came to promote the ecological toilet dry sanitation system in San Luis Beltran. In 1990, 25 dwellers were using this technology, while the NGO was pursuing the project in the follow-up phase.

**45→46:** The support, education and follow-up brought by the NGO contributed to raise the awareness of the first users about the precautions required to make an efficient use of the system. This close partnership motivated the first users, who participated in the improvement of the system's design.

**46→37:** Through their involvement in the development and adaptation of the system for the local conditions, the users were interested in making the most of this technology. This facilitated the acceptance of the dry sanitation system.

Box 4.58. The first ecological toilets in San Luis

*'At the end of the 80s, [Enrique Vignau] a member of CITA, (Alternative Technology Innovation Centre), a national NGO, managed to convince a few families to build an ecological toilet, with urine diversion. At first, 35 [25, actually] ecological toilets were built with the support of the Municipal Civil Engineering Department. 'First we weren't sure if they'd work' explained Don Geronimo, president of the local committee, 'but when the people realised that they worked well, without flies and odours, then they started to get interested in getting their own dry toilet.' Motivated by this success, the citizens managed to get the support of the Municipal president to build some 140 more toilets.'* (Añorve, 1998) cited in (Esrey et al. 1998)

*'Ooh, the ecological toilets, I was one of the first. Mine is 14 years old. They perform well but it is necessary to throw in a mix of lime, soil, and ashes. At the beginning, they did not understand that, and they thought that it would work with stones...We were 25 at the beginning, supported by a brigade from the state government. We started from the beginning so we had more follow-up. But we looked how to save money and instead of using the recommended mix, we used pure ashes, which is very efficient. Some people keep using the mix, but many can't afford a bag of lime that costs \$20, there is no soil, or you need to dig hard into the ground. We've got a lot of ashes from the cooking, we get the wood from the hill or we buy it. It is cheaper that way. The toilet is hygienic, it doesn't smell because of the urine diversion. I put the compost on the field, I plough the soil, it gives very good results. I'm very satisfied with the ecological toilets: apart from the fact that it is hygienic, it provides fertiliser. SI5- Eleasar Sanchez Mecinas (ejidal commissioner)*

Box 4.59. Users adapt the design of the eco-toilet for local conditions

*G: 'Cesar Añorve [environmentalist architect and promoter of ecological toilets in Mexico] came with his work and brought the toilet seat. It cost us some work to design the seat: we did it one way, using a bucket as a cast, but it did not work. The urine separator was a one-gallon plastic bottle neck attached inside the seat by means of an iron string, but this string became oxidised.*

*J: This was a rough and ready system...*

*G: Yes, we looked for a solution, we tried something else, a cement seat, but we could not incorporate the separator in the right way so that women could use it. We designed the urinal cast. Enrique Vignau [director of Espacitos, promoter of environmental friendly technologies in Mexico, promoter of ecological toilets in the state of Oaxaca] had designed one, but it was too big and too heavy.' SI12- Geronimo Perez No.3*

*A: 'If I see that the eco-toilet is a little bit dirty, I brush it, I wash it, I clean it a little bit, and I put a layer of leaves at the bottom, because this is what you need to put in first. You have to*



*put a layer of dry tree leaves at the bottom, so that when the excrement starts to fall, it doesn't stick onto the floor. And then, with the ash, soil and lime, it dries up. But if you don't put the leaves at the bottom and the mix after each use, you can't stand the odours. So we told the people: do this, do that.*

*As local authorities were promoting this, we did several experiments to see how it worked better. With a layer of lime only and the excrement directly on it, we didn't get good results, because the lime gets wet with the cement floor. It forms like a sludge when you want to empty it. We put just ashes... the same: it gets wet as well. So we did several experiments...and the leaves happened to be the best. [...] Because we needed to find something feasible, something that you can do at home. Because sometimes your excrement is wet and sometimes it is solid and it rolls down and sticks onto the walls...I tell you this because I have taken trouble to look at how my toilet chamber works. I've investigated. We also realised that the aperture of the chamber has to be closed with bricks, but not sealed because otherwise there is no ventilation in the compost and it remains fresh, and it needs aeration.' SI2- Agustin Bautista Lopez (Municipal agent in 1990-92 during the introduction of the ecological toilets in San Luis Beltran)*

**37:** The ecological toilet technology was well accepted by the population when the NGO CITA introduced it in San Luis Beltran in the early 90s.

**46→42:** At the beginning, only a handful of people dared to try to use the ecological toilets. The 25 members of the community who accepted to take part in the project were some kind of pioneers, while most of the population was sceptical. These pioneers showed that the ecological toilet could work efficiently and is convenient for the user. Moreover, the involvement of these people in the development of the project generated interest from the rest of the population.

**42→37:** Many community members were already familiar with the ecological toilet and favourable to its adoption, when municipal and state authorities launched two additional eco-toilet projects in the community. This awareness favoured the acceptance of these dry sanitation facilities by more people in San Luis.

#### 4.4. Concepts 37, 41, 42, 43, 44



42, 42→37 and 37: c.f. section 4.3.

37→41: The good acceptance of the ecological toilets by a large proportion of the population of San Luis Beltran was publicised in the media and received the attention of a great number of organisations, which came to visit the community.

41→42: The visits of officials, national and international organisations to the village were perceived as signs of admiration and recognition from rich important people for the users of ecological toilets. They countered the sarcasm and criticisms of the sceptics and detractors of the ecological toilets, and persuaded unsure community members to adopt the dry sanitation approach too.

43→42: Motivated by the successful adoption of the ecological toilet by the first 25 ‘pioneers’, the municipal encouraged the construction of more dry sanitation toilets in San Luis Beltran. The authorities provided the material (bricks, cement, toilet seat...) but the beneficiaries had to provide the workforce.

44→42: Most men in San Luis Beltran have masonry skills, so the construction of the ecological toilet was not an obstacle for most community members. During the 2<sup>nd</sup> and 3<sup>rd</sup> projects (supported by the municipal and state authorities) they built their ecological toilets by themselves, without having to spend money on hiring professional masons.



**Box 4.60. San Luis Beltran becomes famous for its ecological toilets**

*'What I know is that from the next year on and for two or three years, maybe four or five, they received many visits from a great number of people. Of course, people from the municipality, people from the [state] government, people from various federal institutions: the Social Development Office, the Health Office, the Environment Agency, the Water Commission... people from other states came to visit them. I can remember they told me about people from Nayarit and other states as well. People from other communities from the state of Oaxaca came to visit them: they were aware for some reason, that there was this community with these toilets, and they came to know it to see how it worked. People from France went to visit them, they told me... people from the World Bank and from foundations like Banamex... They came to see them a lot. They had a whole protocol, which was well established, because it was very frequent for them to receive visits, like every month, every two months from important people, and the city or state government itself was coming and helping them [...]*

*I came up there several times, and the general opinion was that the toilets worked well, that they liked them, and that the people were satisfied. This was what we wanted. Time passed until 1996 or 1997, the last time I went there was probably in 1997, and there was more news: the toilets were working well and people were still accepting them. The television made several documentaries, the local television of Oaxaca, for instance, in the newspapers, and some people were writing reports for newspapers from other places... thus, they were proud of the toilets, it was important for them, it was a reference point, and they knew it.'* SI20-Enrique Vignau, (NGO CITA Espacitos)

**Box 4.61. Ecological toilet, a dry sanitation system**

**Figure 4.20. Ecological toilets in backyards of San Luis Beltran**



*The ecological toilet consists of two impervious 1m<sup>3</sup> brick chambers that are filled up successively. The design of the toilet seat incorporates a urine diversion system, which evacuates the liquid through a hose pipe into an absorption pit (hole with gravel) in the soil. Only the excrement falls into the chamber that is in operation. A cup of soil, ashes and soil mix is poured after each use in order to decompose and dry the faeces and neutralise the pathogens. Once a chamber is full, it is sealed and allowed to rest during the operation of the second chamber (residence time varies from 4 months to one year depending on the number of users). The chamber is then emptied and the stabilised 'compost' can be used as fertiliser.*

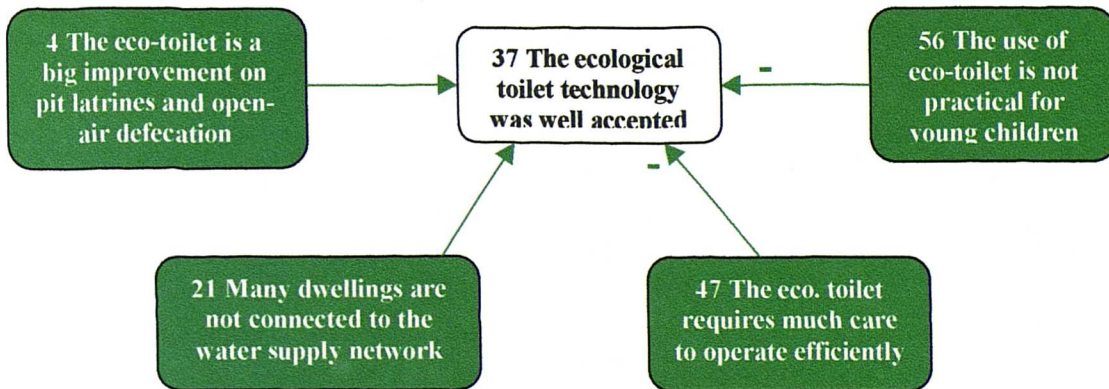


Figure 4.21. Urine diversion toilet seat



Figure 4.21. shows the latest design of the ecological toilet seat. It can be made of cement or resin and painted. Many village workshops have the casts to produce these seats, which are made of cement and cost around \$US7 per unit.

#### 4.5. Concepts 4, 21, 47, 56



**4→37:** The ecological toilet is a very significant improvement in terms of sanitation, when compared to open-air defecation and pit latrines (basic and ventilated). Most people in San Luis Beltran were using very basic sanitation facilities when the first ecological toilet project was launched, which explains why the community quickly adopted this technology.

**37:** c.f. section 4.2.

**21:** c.f. section 2.3.

**21→37:** Many people do not have access to the water supply network, which makes it impractical for them to use a cistern toilet. The ecological toilet does not require water to operate and thus met the needs of many inhabitants.

**56→37:** The ecological toilet has few requirements for optimal operation. A mixture of soil, ashes and lime needs to be poured in after each use; failure to do so can rapidly cause inconvenient odours. The user must make sure that the urine falls in the urine-

diversion compartment, which is a real issue for young children, since the toilet seat is not ergonomically designed for them.

**47:** When compared to the most common excreta disposal systems (i.e. latrines, cistern toilets), the ecological toilet requires much attention to operate efficiently. The convenience it provides depends on the care of its users. Failure to pour an adequate mix into the chamber after each use can generate bad odours, attract flies and hinder the drying process. Moreover, the chambers have to be emptied about twice a year.

**47→37:** The sensitivity of the ecological toilet and its special operational requirements provided ammunition for people who were sceptical about the appropriateness of this sanitation system.

#### Box 4.62. Benefits and shortcomings of the ecological toilet

*'Regarding what you're telling me about this Swedish magazine, about the ecological toilets, this system, have you already seen it? [I nod], you've already seen how it works, they brought these to us during the term of office of the municipal agent (community leader) Agustin Bautista Lopez. And what happened with Agustin? Well, indeed, at the beginning it did not take him much effort to convince the people, the people that started this project, it was not difficult for him to promote this new sanitation system, because previously, there were only pit latrines.'* SI8- Francisco Pacheco (ex-community leader)

*'The kids don't always use it properly, they're not careful. So it is really annoying when you need to clean the excreta from the urine pipe. Or sometimes they urinate in the dry chamber.'* SI6- Enrique Bautista

*Q: Can everybody use it properly?*

*- 'The kids don't use it, but my 8 year old daughter knows how to use it.'* (Virginia Remedios)

*- 'Yes, we all belong to the same family, we are used to using it, we teach them from a young age.'* (Saul Melchior Acevedo)

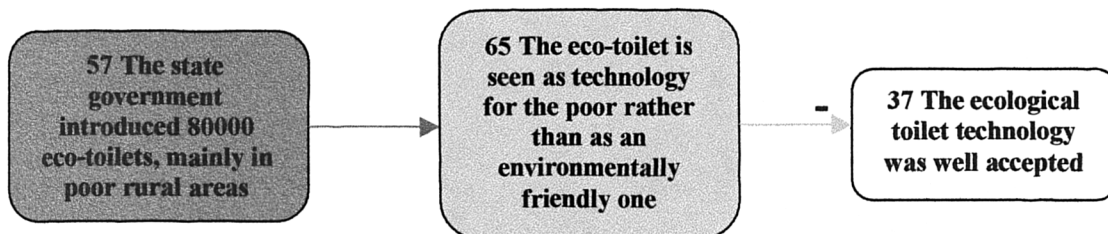
*- 'No, the small kid uses a small bucket, the seven year old girl uses it properly, she pours the lime and burns the toilet paper that is used.'* (Irma Gutierrez Herrera)

*- 'At the beginning, my five year old son could not use it well, he was used to the cistern toilets, but now he's learned.'* (Rosa Lopez Guerrero) SR3- SLB Survey

*'Personally, I don't like the dry toilet very much. I don't like it because there is [it requires] a lot of work: prepare the mixture, and if you neglect it...'* SI18- Señora Bautista

*'These ecological toilets work very well if you pay attention to them. But if you don't, you're not going to obtain good results. If you are lazy or you forget, and if you go to the toilet and you don't pour in the mixture that you ought to use, the toilet becomes a mess in a matter of two or three days. You can't stand it anymore, because of the stench. But if we always go to the toilet and then use the ashes and lime, all this, it works, and this is what we do now. [...] Because the first thing they say is: 'Ooooh, a chamber has already filled up!!! Already, it has already filled up!', and they think: 'I'm gonna use the other one.' But they forget, because they're lazy as we say...and both the chambers are already full!!! Of course, one is ready to be emptied, but the [content of] other one is soft, as we say, fresh. And this is the problem 'Damn, I don't have time! I go there and there, and I don't have time.' SI2- Agustin Bautista Lopez*

#### 4.6. Concepts 37, 57, 65



**57:** The outstanding success of the ecological toilets project in San Luis Beltran led the state government to transfer this technology to hundreds of remote rural communities throughout the whole Oaxaca state. A huge program, mainly financed by UNICEF was launched between 1992 and 1997 to build an average of 15000 toilets per year.

**57→65:** Few people perceive the high 'environmentally friendly' value of the ecological toilets. Generally speaking, the inhabitants of San Luis Beltran regard this system as one that rich people would not use, as a technology for the lower-middle and lower social classes. They find it most appropriate for the rural areas and for zones experiencing important water shortage situations. The fact that more than 80,000 ecological toilets were given by the government to people in isolated rural communities, and that neither rich people in the city nor in T-V soap operas use it, support this point of view.

**65→37:** The pejorative 'sanitation for the poor' connotation does not encourage people to make the most of the ecological toilet. Instead, they tend to consider it as a more or



less temporary system that a cistern toilet will eventually replace, when the sewer system is operational. By having a negative image of the ecological toilet, many users don't use it properly, and consequently their systems work at low efficiency, providing little convenience. The few people who use their system carefully and who decorated it (i.e. painting, tiles) to make it more comfortable and easier to clean are not numerous enough to alter the negative view most people have about the ecological toilets.

**37:** c.f. section 4.2.

Box 4.63. A sanitation system for the poor?

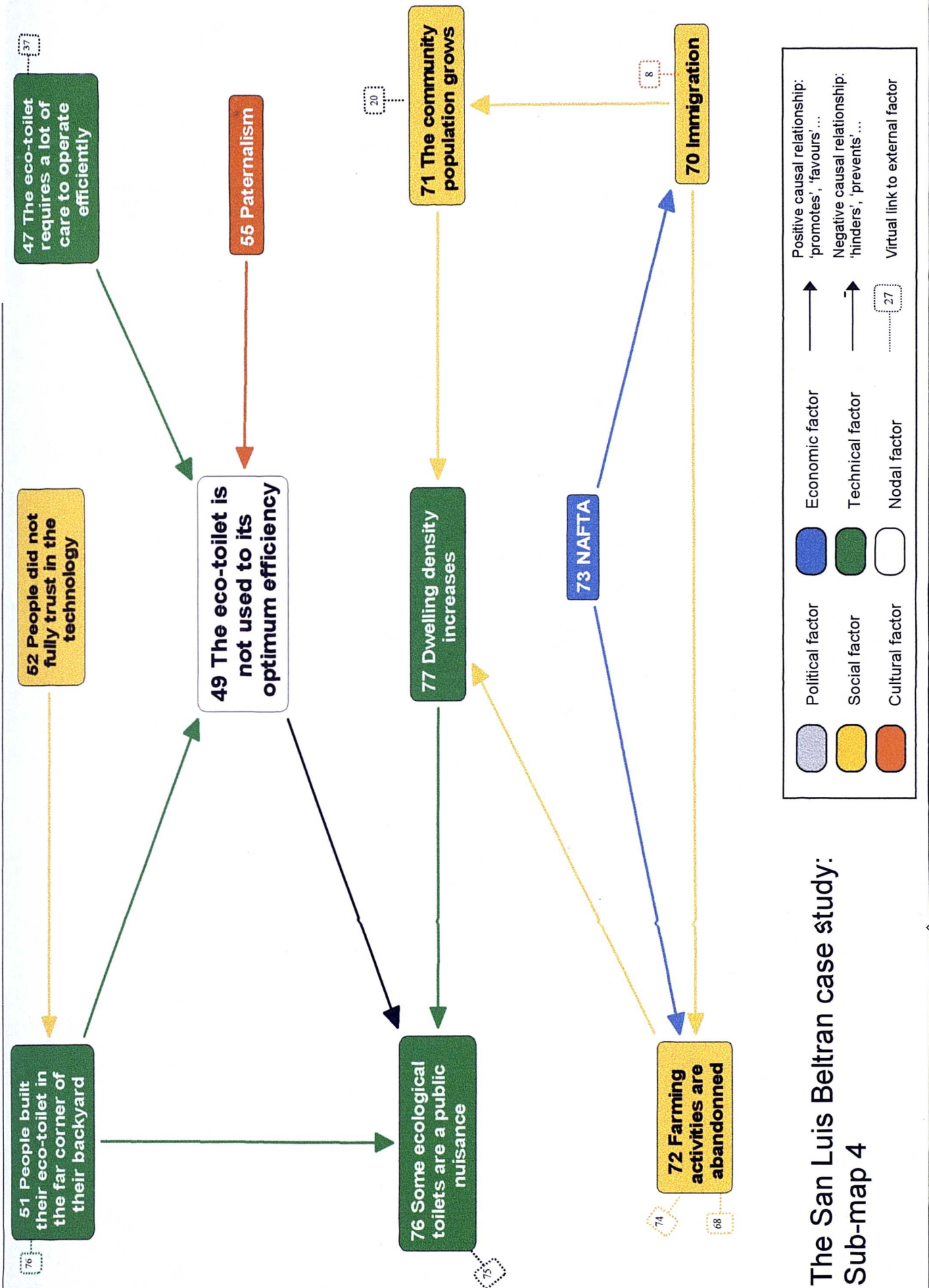
Q: Do you think that the kind of toilet that one uses is related to the economic situation?

- 'Yes, the people who have better wages will have more elegant toilets. I get ashamed when richer people come here. The rich people have a cistern toilet connected to a pit, we wouldn't have it that way if we had the money.' (Saul M. Acevedo, eco-toilet at home)

- 'Yes: somebody told us: 'you're like cats: you cover your shit!'. The ecological toilet is for the more most miserable people of the world.' (Hermilla Herrera Colon, eco-toilet at home)

- 'No, it depends on awareness: if we all agreed to use ecological toilets, this would be an alternative. We use the cistern toilet, and when the water gets low [scarce], we use the other [the ecological toilet] to keep water for the animals [two bulls].' (Sr. Garcia)

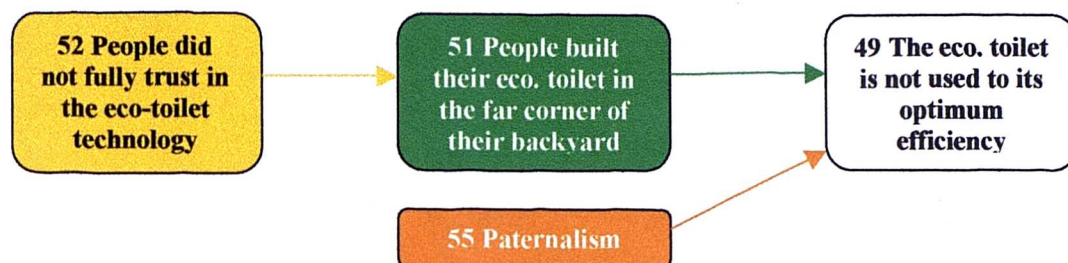
- 'Yes, the people who built their ecological toilet just had to buy the toilet seat and the hose pipe [the government paid for the rest]: it is more for the poor people.' (Eva Hernandez, 50, pit latrine) SR3- SLB Survey



## The San Luis Beltran case study: Sub-map 4

## 5. Sub-map 4

### 5.1. Concepts 49, 51, 52, 55



**52→51:** Very few people were confident enough in the ecological toilet technology to build their toilet right next to the house (nobody in the community built one inside the house, though it has been successfully experimented in city houses). Thus, most people have their ecological toilets in the far corner of their backyard, as if they had already rejected it before using it.

**51→49:** The remoteness of the toilet is an issue for old people and for children, when they need to use it at night, for instance, or when it rains, or when they are ill. This ‘buffer’ distance between the house and the toilet allows the untidy and ‘lazy’ users to neglect the sanitary facility: they are only affected by the bad odours when they use it.

**49:** In most cases, people do not use their ecological toilet to its maximum efficiency. When used properly, it is absolutely odourless and the compost is perfectly dry when the chamber is emptied.

**55:** Paternalism is a basic feature of the Mexican culture. Seventy years of very centralised government under the ‘democratic dictatorship’ of the single party in power, the PRI, left its imprint very strongly in the relationships between citizens and the political authorities.

**55→49:** Many pit latrine users also have an ecological toilet in their backyard, which is not in operation. People use it as a storehouse. They built it because the government gave them the material, but they do not use it because their pit latrine has not filled up yet, and it meets their requirements so far. Others feel that the ecological toilet will not bring a real improvement.



## Box 4.64. Ecological toilet pushed away into the back of the garden



Figure 4.22. Ecological toilet in the corner of a backyard

Most ecological toilets are located 10-20m from the house.

Q: Is the distance separating the toilet from the house an issue for you?

- *'It is close to the house and it doesn't smell, they clean it daily.'* (Rosio Acevedo, 40 years old)
- *'No, on the contrary.'* (Maira Gutierrez Lopez, 35)
- *'This is an issue because of the odours.'* (Julio Gutierrez Vasquez, 28)
- *'Yes, when you are ill or when it rains.'* (Israel Mecinas Caballero, 78) SR3- SLB Survey



Box 4.65. Paternalism and the motivations for being part of the ecological toilet program

Figure 4.23. Ecological toilet used as a storehouse



(Other uses include hen-houses, piggery...)

*F: 'Many people made improper use of the material. Over there, on this side, there is a family that asked for material for seven [ecological] toilets! But they built the roof of their house with this material!'*

*J: They were given all the material?*

*F: Yes, they gave them bricks...*

*J: But they were not fined?*

*F: No, they said that they would do a...an evaluation, but nothing happened. Seven latrines! [eco. toilets], they asked for!*

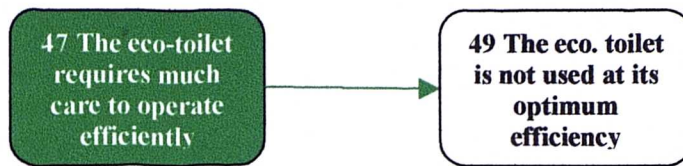
*F's wife: For each one of her children... ' SI9- Filiberto Perez*

*'For decades, the state Health Office and Social Security Office had promoted the pit latrine as a way of controlling epidemic outbreaks. [...] There was the experience of San Luis Beltran, testimonies and support, and the government wanted to promote the ecological toilet, so it made it easier for us to organise meetings for the promotion of the system and people started to accept it more easily. Moreover, from 'they don't give me anything' to 'they give me a pit latrine that I know that will stink' to 'they give me something that may not stink that much, and if it is what they give, well I accept it!' and they started to accept it. Of course, at the beginning they accepted it not because they were convinced that it worked well, but because 'this is what they give me, and if they don't give me anything or if they give me this... [I should take it anyway]'. There are several villages where they used the material to build a basketball court or to fix the town hall, but the [state] government could not do anything because if the whole village does it, they can't put everybody into jail. But there were other villages where they punished those who did not finish the construction of their toilet. In many villages they said: 'Those who don't finish until this day will be fined!' Some even said: 'Those who do not finish on time will be sent into jail', the municipal president said [...] In these villages, the toilets worked perfectly, and several years later, when we came to visit them, in the Mixtec zone, the ecological toilet was working fine. SI20- Enrique Vignau, Espacitos*

*'In some communities, that kind of approach [participatory approach] will be difficult to implement as the paternalistic attitude of the people is firmly rooted. It is possible that there, they have to wait for the death of the old people... However, in many communities, people understand the benefits they can get from such a change of attitude. CEAPA (Water supply and Sewer State Office of Aguascalientes) changed its attitude and do not offer free services anymore: we wait for the demand from the people and we charge them for it.' T11- CEAPA*



## 5.2. Concepts 47, 49

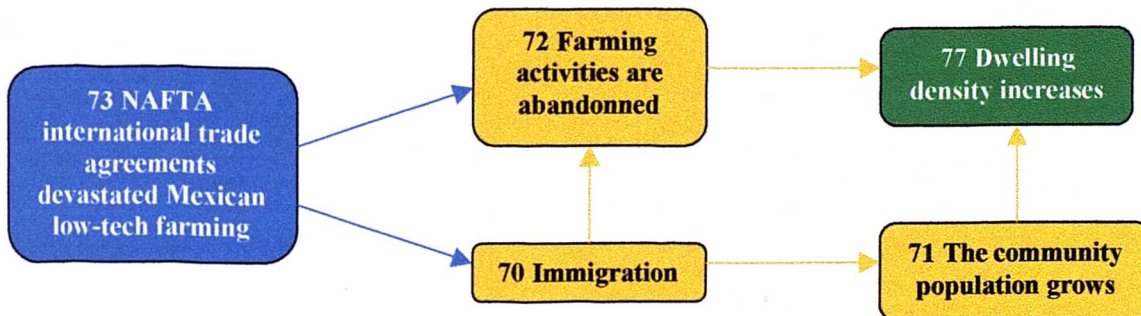


**47:** c.f. section 4.5.

**49:** c.f. section 5.1.

**47→49:** Most people do not pay enough attention for the optimal operation of their ecological toilet. Very few people use the soil-ashes-lime mix recommended to break down the excreta, dry it and neutralise the pathogens. Consequently, there are bad odours in the toilet, which in turn tends to attract flies, the excreta does not decompose and dry properly in the composting chamber (c.f. Box 4.62. section 4.5.).

## 5.3. Concepts 70, 71, 72, 73, 77



**73:** In 1994, the North American Free Trade Agreements (NAFTA) had a profound impact on Mexican agriculture, badly affecting the peasants who lived on the cultivation of rain-fed maize and beans.

**73→72:** NAFTA put enormous pressure on traditional Mexican agriculture and made the ejido farming sector unable to compete with the US corn producers, leading millions of peasants to abandoning farming.

**73→70:** NAFTA caused millions of peasants from south Mexico to move, alone or with their families, to cities, states in the North, or to the U.S.A, in search of employment. Though most of the migrants to San Luis Beltran are quite rich people that left the city

for a quiet place to live, some of them were driven to the community as a consequence of the dramatic effects of NAFTA on the ejido farming sector.

70: c.f. concept 5 section 2.2.

70→72: The price of the land has increased exponentially during the last decade, accordingly to the rising number of newcomers willing to buy a parcel to settle in the village. Most of the ejidatarios of San Luis thus decided to break up their cultivated land in order to sell lots to the immigrants.

72: While in the past, most of the people in San Luis Beltran were peasants, farming was progressively abandoned during the last decades and there are now less than five old peasants left.

72→77: Higher dwelling density in the village resulted in part from the sale of agricultural land to newcomers.

70→71: Immigration in San Luis Beltran during the last decades contributed to population growth in the community.

71: c.f. concept 34 section 2.2.

71→77: As population increases, more dwellings are built, and density gets higher.

77: Dwelling density has increased a lot in the community during the three last decades.

Box 4.66. NAFTA affects the ejidal farming sector and provokes massive immigration

*'In just over a decade, the cradle of support which Mexico's peasants counted on, unravelled, measure by measure. Starting in 1988, Mexico reduced or ended agricultural subsidies, credit and other help to small farmers; by 1994, NAFTA opened Mexico's protected markets to tons of foreign products, including corn and beans, driving their price down, and leaving local farmers at a loss. Multinationals like Archer Daniels Midland and Cargill entered Mexico's grain market, exposing campesinos to competition they were not prepared to face.*

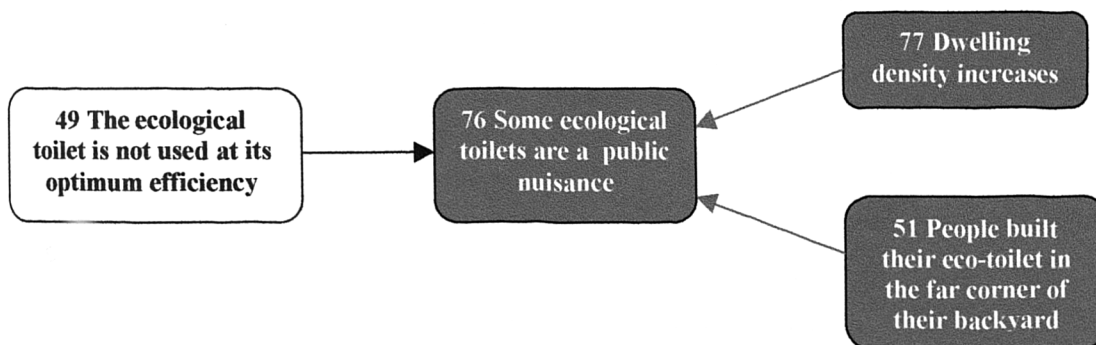
*[...] 'There was an ideological decision not to support Mexican agriculture where it does not have a comparative advantage' relative to American agriculture, says Suarez. 'They saw it as good money thrown at a lost cause. And what should the farmers do?' he asks. 'They should go to another sector of the economy, they thought, or to the United States.' [...] Only with the passage of the North American Free Trade Agreement in 1994, however, did the larger public give this process a name. NAFTA immediately became a powerful symbol of the economic growth and increasing poverty that was tearing Mexico apart. In the last five years, the percentage of Mexican homes subsisting below poverty levels - with less than 560 pesos,*



or just over \$60 a month-went from 69% to 76%. All this while the economy has been growing unchecked for over 4 years. NAFTA's provisions also accelerated the process it had brought to public debate. Foreign investment and products reached far into Mexican markets; maquiladoras mushroomed along the border, and reforms whipped through the countryside. The agreement brought globalisation home to Mexico in the form of tariff reductions that flooded the market with inexpensive American corn grown on mechanised, large-scale farms; beans, rice and wheat soon followed.

Soon, the 2.5 million tons of corn allowed by NAFTA into the Mexican market tariff-free turned to 4 million tons, then to 6 million, and even 8 million, in 1996. 'In reality, no attention was paid to the more conservative aspects of NAFTA, to the maximum quota of imports,' says Rosset. 'The same thing happened to beans. Many months the imports have doubled, tripled the amount allowed. They basically opened the floodgates.' Corn feeds Mexico, and up to 18 million people depend on its production. Experts predicted that allowing cheap American corn would ravage the ejidos, where 70% of farmers worked, producing 73% of country's corn. One study by economists Santiago Levy and Sweder van Wijnbergen predicted that two million ejidatarios and campesinos would leave the country for the city if corn tariffs disappeared; the number could reach 5 million with families, they said.' (Barbassa 2001)

#### 5.4. Concepts 49, 77, 76



**49:** c.f. section 5.1.

**49→76:** Some people do not pay much attention to the operation of their ecological toilet, which then produces bad odours and attract flies.

**76:** In certain cases, where the users disregard the basic requisites for the proper functioning of their ecological toilet, the neglect is such that neighbours and passers-by are affected by the stench.

**51:** c.f. section 5.1.

**51→76:** Some inhabitants in San Luis Beltran have their ecological toilet in the corner of their backyard, and fail to give it the required attention. As a result, these toilets produce bad odours, which are a real nuisance for the next door neighbours and for passers-by.

**77:** c.f. section 5.3.

**77→76:** Higher dwelling density makes the nuisance associated with inadequate operation of the ecological toilet more noticeable in the neighbourhood. If a user discharges insufficiently dried compost in his or her backyard, the neighbours and passers-by are likely to be inconvenienced as the average size of backyards has considerably shrunk.

Box 4.67. Higher dwelling density: filthy ecological toilets trouble the passers-by

*F: I built one [ecological toilet], but my wife did not like it, because you have to go up...*

*F's wife: No, it stinks a lot, whatever you add: lime... or whatever, there is somebody who has one of these over there, and I can smell it when I pass by...*

*F (laughing): It is also that they don't know how to use it!*

*F's wife: My husband always got us used to deep pit latrines so that we could sit on the toilet. They were very deep, and when he could see that it was half full, he filled it up again with soil and dug another one next to it. And it did not smell at all. ' SI9- Filiberto Perez and his wife*

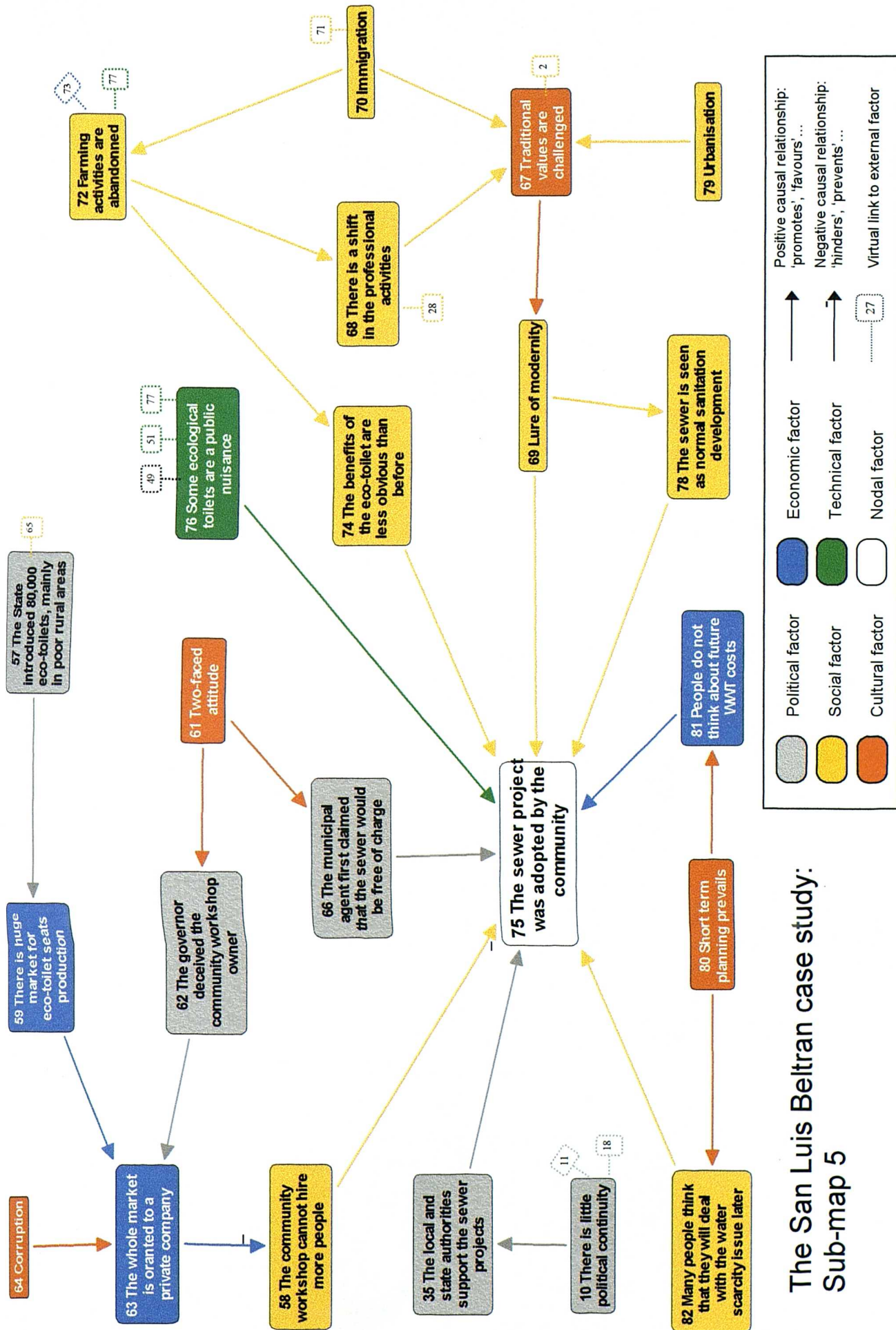
Figure 4.24. Higher dwelling density



*The population growth of the last decades led the community members to fragment their land into small parcels to enable their children to build their own houses. The price of land boomed in the recent years, due to the growing interest of rich newcomers wanting to settle in the village. Besides, the incomes generated by farming*

*activities have dropped as NAFTA opened the floodgates to invasive imports of basic foodstuffs, which made the local produce uncompetitive. The extent of arable land has reduced as a result of these pressures, and dwelling density increased. As a consequence, on-site sanitation systems have to be efficient and better maintained to allow the neighbours to coexist in harmony. Twenty years ago, it was not really a problem if one's neighbours' latrines were filthy or if they were defecating in the open air. The backyards were large enough to limit the scale of the nuisance. Nowadays, the lack of hygiene associated with excreta and urine disposal is often a source of trouble. Thus, an ecological toilet that is not used and maintained properly causes trouble for the neighbourhood. SR2- SLB Description*







## 6. Sub-map 5

### 6.1. Concepts 67, 68, 70, 72, 79



72: c.f. section 5.3.

68: c.f. concept 6 section 2.4.

72→68: As farming activities have become more and more marginal due to economic and demographic pressures, the population of San Luis Beltran has turned to a wide range of alternative professional activities, within the community or in the city.

68→67: c.f. relationship 6→8 section 2.4.

67: c.f. concept 8 section 2.4

70: c.f. concept 5 section 2.2.

70→72: c.f. section 5.3.

70→67: c.f. relationship 5→8 section 2.4.

79→67: The recent extension of Oaxaca City has brought the urban world to the community's doorstep (c.f. Figure 4.19 section 4.1.). The people of San Luis Beltran used to spend most of their lives isolated environment of their village, apart from on the market day in the city, where they would sell their tomatoes and chilli. Nowadays, the community has much more interaction with the urban world, which contributes to weakening their traditional values.

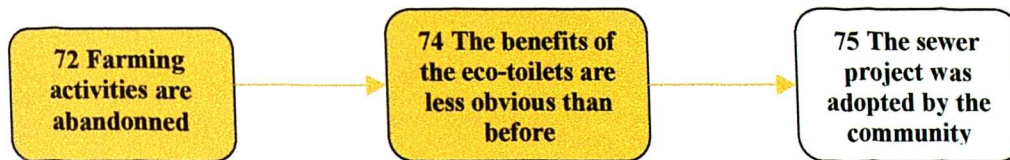
**Box 4.68. The urban world at the doorstep of San Luis Beltran**

*M: 'There was...you see the city of Oaxaca, well it was like a small village, and it grew little by little. [...] It was raining from April to October, so there was a lot of water on the hill, and we never lacked water, when the crops needed water, people would just divert the river to irrigate...and there were very few people. But now, the Mexican territory is full of people, sooner or later, people will not have space to farm. So, with the abundance of people, and the decrease in rainy seasons, we're living with the worst of calamities. With the population growing and growing, well, the land cannot carry everybody. [...]*

*J: 'And the distance to the city was greater in the past?'*

*M: 'Yes, we were taking about an hour to reach the small town, on foot, there were no cars, there was nothing.' SI14- Manuel Acevado Luria (97 years old)*

*From the community water tank, there is a superb view of the hills where the water comes from (c.f. Box 4.42 section 2.1.). By turning back, a panoramic view of Oaxaca City in the valley can be enjoyed. Geronimo explained that the neighbouring village on the right hand side, Donaji, is much richer than San Luis Beltran. They used to have vast ejidal lands and they sold most of them. Most of the fields that people used to cultivate have now become urban zones. This is why people from Donaji now cultivate the lands up on the sides of the hills, where nobody used to farm. SI11- Geronimo Perez No~1&2*

**6.2. Concepts 72, 74, 75**


**72:** c.f. section 5.3.

**72→74:** Most farmers readily perceived the benefits of the ecological toilets as they tacitly understood the processes at work, and they made the most of the compost as organic fertiliser for their maize, chilli and beans. But the abandonment of farming activities reduces the perception of the advantages of environmentally friendly technologies, such as the ecological toilet.

Box 4.69. Farmers benefit from the fertiliser value of the ecological toilet compost

*M: 'You empty the other chamber and discharge it [the compost] to the field, because it has already...already...lost its odour, and has become almost like soil. And you put it in the field and mix it with the soil, and the harvest is very good because it is mixed with the soil.'*

*J: And do you think the sewer is a good thing?*

*M: 'No, because the sewer runs along the river and contaminates the wells that they make to supply water to the houses. And this thing (the ecological toilet) that we already have is better because it produces pure soil that is useful for the soil, it helps the soil and gives a good harvest.' SI14- Manuel Acevado Luria (97 years old)*

*'So this project sounded very favourable to my population, and further on, we'd have many more benefits. We started the project that was very beneficial for maize, for chilli and tomatoes. The compost from the toilet is useful for the plants. We all saw that and it was very profitable. At first, amongst the population, there were people who were negative. SI2- Agustin Bautista Lopez*

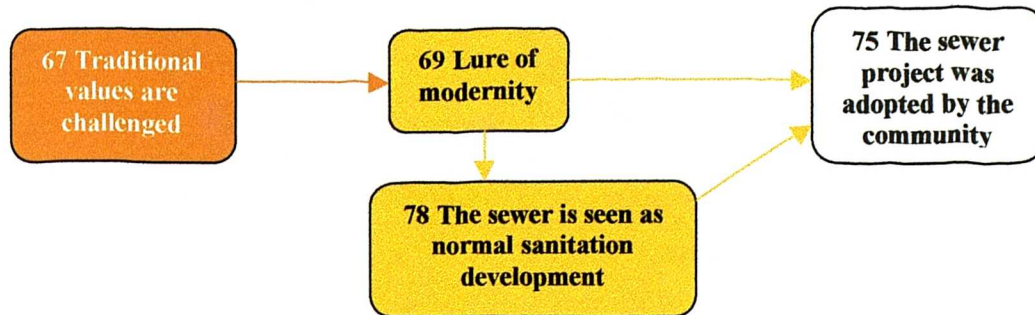
*'And so, for el Dia de los Muertos [Mexican traditional religious celebration of the dead] I am growing flowers here. And...flowers this size!! Because I used the fertiliser [the ecological toilet compost], and they took snapshots. But some were [arguing] 'But can you use it for tomatoes and chilli?' Of course, you spread it on the field and you blend it in the soil by ploughing the field, and it disappears automatically. This is fertiliser...[...] Thus, in this way, it doesn't matter if it is that kind of fertiliser, it produces, it makes the soil produce. But as people always find some reason to disagree, [they said: 'I'm not going to give these flowers to my saint, or whatever, they sow the seeds where the dirt is!! [i.e. 'where the compost made of excreta is'] But it is not true, because...' SI5- Eleasar Sanchez Mecinas (ejidal commissioner)*

**74→75:** Changing view of the benefits associated with the ecological toilet made easier the adoption of the sewer system, a radically different approach to sanitation, whereby water consumption increases and nutrients are sent away.

**75:** The sewer system project was adopted by the population after a vote in a community assembly.



### 6.3. Concepts 67, 69, 78, 75



67: c.f. concept 8 section 2.4

67→69: Traditional values are challenged. The numerous inhabitants who work in the city and those coming back from the USA get very sensitive to the convenience of the urban middle classes (i.e. many shops nearby, a nice living room, a tiled bathroom with a nice cistern toilet inside the house...). For the majority, this convenience is not affordable, but they work and upgrade their house little by little in that perspective. The old people are less attracted by the convenience and modernity, as they usually remain in the village all the time.

69→75: People who live in the metropolitan zones of big cities, such as Oaxaca City, are influenced by urban development and the material comfort it provides. Many people from San Luis Beltran feel that the use of the ecological toilet is not acceptable in a village located right next to the city. The 'cistern toilet-sewer system' approach is regarded as a norm of development and represents a sign of on-going material and social progress. This encouraged the community members to adopt the sewer project.

Box 4.70. The sewer project: symptom of the lure of modernity?

*'Well, on the one hand, it is not so good because we live up there, and we affect the people down there and all the people that live down in the valley. So we understand that the normal toilet, that is, the cistern toilet, is better for the people but we affect the others because they receive the sewage. There is much more contamination for those who live in the valley [...] Whether it is necessary or not? Of course it is, because it is time for us to improve the village, which is right next to the city, so that this community needs to improve. Yes, this is necessary and better for the community. Life is going to be more convenient for the people who live here.'* SI15- Navidad & Serapio Acevedo

*F: 'Listen, well, I believe there is a little bit of illusion, because of the [ecological] toilets, well, some even have it inside their houses [...] and it has proved to work for these people.'*

*Thus, there are no bad odours, which is the main reason why people run away from it [...] So probably people are a little bit afraid, and they are lured by modernity.' SI8- Francisco Pacheco*

*'With the previous government, we had never-ending conversations, and the officials did not accept [the ecological toilet]. At the same time we had talks in assemblies, we talked with the people and there was the illusion of the modernity: the sewer system etc...One in 50 accepted [...] The difficulty there was the illusion of the west, of the flush toilet. When the new government accepted the [ecological] toilet and launched a program, though it was not considered to be a sanitary infrastructure by the [federal] Health Office, they managed it at state level, and did not care [about the federal regulations], they promoted the idea more.'*  
SI20- Enrique Vignau, Espacitos

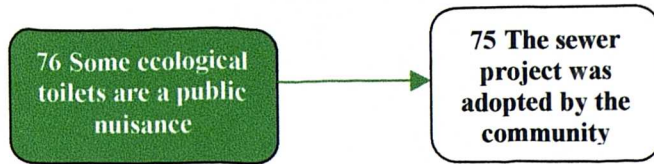
**69→78:** The construction of a sewer system in a community is generally perceived as a normal development step following the installation of electricity lines and a potable water supply network. People feel upset if they do not have this service, they feel excluded from the national development trend that leads community people to enjoy the conveniences cities provides for their inhabitants: 'flush and forget' sanitation. In the official statistics produced by INEGI (National Institute of Statistics, Geography and Computer Science), the main indicator for sanitation is sewer coverage (as % of the population).

**78→75:** The fact that most people view the sewer system as the modern, normal and preferable sanitation approach encouraged the adoption of the sewer system project.

**75:** c.f. section 6.2.



#### 6.4. Concepts 76, 75



**76:** c.f. section 5.4.

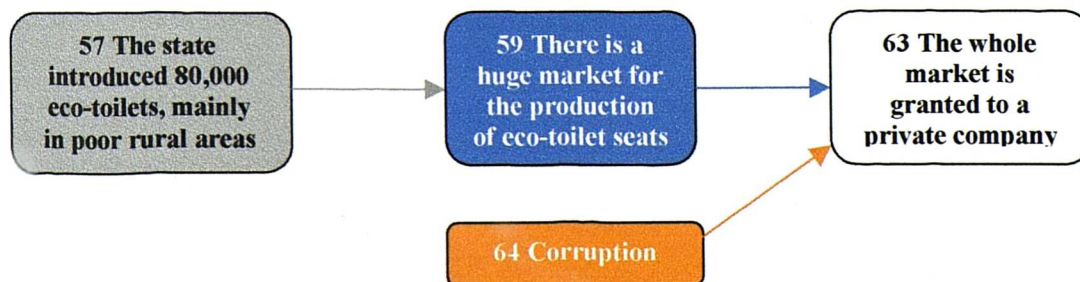
**76→75:** The nuisance caused by the mis-use of several ecological toilets in the village tended to bring discredit on this technology and provided strong arguments in support of the adoption of the sewer system.

**75:** c.f. section 6.2.

#### Box 4.71. The sewer system: more hygiene for all

*A majority of the people believes that the sewer will be a benefit for the community. It will remove the wastes and there won't be grey water running down the streets anymore. People also consider that there are still many inhabitants with very poor sanitary practices: people defecating in the open air or using pit latrines and ecological toilets. It actually seems that several inhabitants do have latrines or ecological toilet in very poor hygienic conditions, which leads a large part of the population to support the sewer system concept with greater conviction. SR3- SLB Survey*

#### 6.5. Concepts 57, 59, 53, 54



**57:** c.f. section 4.6.

**57→59:** The commitment of the state authorities to support the construction of 15,000 ecological toilets per year for six years creates an enormous market for the production of ecological toilet seats.



**59→63:** This colossal market is granted to Anfora, a private company in Mexico City.  
(ps: there is no real cause-effect relationship here, but rather one fact preceding the other)

**64:** Corruption is an important feature of Mexican culture. It pervades most of the institutions and all levels of the society.

**64→63:** The ecological toilet program launched by the state government was affected by a series of frauds involving government officials at the top of the hierarchy, and notably a private company, which managed to corner the entire market of toilet seats production, at the expense of a dozen community workshops.

Box 4.72. Fraud in the state ecological toilet program

*'One day, we were in the office of the civil engineering department, waiting to get an order, and at the same moment, people from Anfora arrive, and one of them asks the official: 'How do I do the cheque?' [What is the bill?], - 'As you like' [he replies]. A \$80,000 cheque!! And he had the impudence to show us the cheque! [...] This was a present for the official.' SI12-Geronimo Perez No.3*

'The Anfora business, which produces toilet seats, is in the process of patenting this technique (of Vietnamese origin which has existed in our country since the 1980s) for themselves and is trying to stop production by indigenous and rural communities in our country who have installed modest workshops to produce these toilets!! Anfora's action will undermine the affordability of this ecological technique and bring to an end the jobs of hundreds of self-employed people who express their ecological convictions by this work. Anfora wants to insure its profits even though it has done nothing to design or improve this technique, nor to promote its proper use (doing so would prevent a guaranteed disaster: experience has demonstrated that without follow-up these toilets do not succeed in transforming habits).

Our friend, Alfonso Silva is one of the hundreds of popular experts in ecological sanitation throughout Mexico, who earn their living fabricating urine diverting bowls for ecological dry toilets in small family workshops for many years before the businessmen of Anfora, even knew of this technique.

To refresh the memory of the gentlemen of Anfora:

Gentlemen: Have you forgotten that during Mr. Dióodoro Carrasco's term as Governor of Oaxaca a government official of the Ministry of Urban Development and Public Works sent you one of the bowls made by Mr. Jerónimo Pérez (Alfonso Silva's partner) so you could manufacture them by the thousand? Maybe you do not remember, maybe you do not even know that your first millionaire contract with the government of Oaxaca is due to the exemplary work of people like Don Jerónimo of San Luis Beltrán; it was in his bowl producing workshop where most of the government technicians were trained at that time.

You also most certainly do not know that in 1989, five years before you easily cornered public funds with the sale of thousands of urine-diverting bowls to the government of the state of Oaxaca, the group Espacios Culturales de Innovación Tecnológica was already offering technical training to the Ministry of Urban Development and Public Works of Oaxaca for their dry toilet installation programs, and Espacios was also disseminating the diverting bowls which you pretended to 'invent' eleven years later.' SI36- Cesar Anorve (e-mail to Anfora and discussion list)

*J: 'So you know about the program of dry sanitation that the state launched between 1993 and 1998? Was it a successful program?*

*Ju (Julian): Yes, of course, I was very well informed on everything that happened in this period and especially on this issue. This was indeed a successful program: thousands of people received ecological toilets in the whole State. It could however have been much more successful if one considers the enormous amount of money that got lost... [...]*

*J: How did you get to know about that?*

*Ju: [...]*

*J: So you probably know X, who participated actively in that program?*

*Ju: Yes, of course.*

*J: X is actually the person I got in touch with before coming here in Oaxaca. He also put me in touch with Y. I will probably interview both of them to know more about how the whole program developed...*

*Ju: Ooh! Y!! You know you should really be careful with Y in your investigation. Y was at the top of the project management and Y is a very influential person. I recommend you to take great precautions with Y. You must know that this was a huge program and I guess you don't quite realise the amount of money that went through the project. This was funded by international agencies (UNICEF...) and the amount of money that got lost, the number of toilets that are supposed to exist and that you can't find on site, the extent of the corruption that was achieved in this program is colossal. Wait! We are not talking about a few millions of pesos, we are dealing with many many millions of lost pesos. This was a big dirty business [...]*

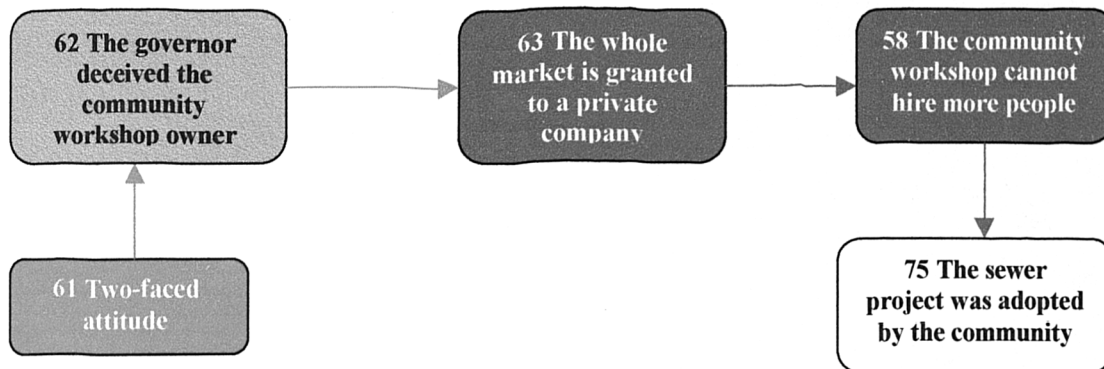
*J: And was this corruption denounced publicly?*

*Ju: Yes, some people did some investigation about that: they collected data and built up files that consistently accuse the government of acts of corruption, personal enrichment...*

*J: So what happened?*

*Ju: Well, the people who gave the information had to leave the government, the accusation was made but nothing happened... You know how things are in Mexico... All the system is corrupt, from the top to the bottom, and if you don't follow the rules of the system, you leave. The system remains the same. [...] Now, the new governor became aware of all this corruption in this program but you know how things are: we are in a very intense pre-electoral period with much tension and you cannot expect a politician to denigrate and prosecute his own party: this would be political suicide. SI22- Anonymous*

## 6.6. Concepts 58, 61, 62, 63



**61:** The Mexican people excel in the art of dissimulation, that is in the ability to play different roles in different contexts. This two-faced attitude, which is notorious in politics, where it is generously accentuated, forms part of the Mexican culture (c.f. the ‘El Mirador’ case study Box 4.19 section 3.10.).

**61→62:** Geronimo Perez, the owner of the workshop producing ecological toilet seat in San Luis Beltran, had the opportunity to show his work to the state governor. Diódoro Carrasco assured Geronimo that he would help them and provide more work for the workshop. However, he never kept his promises, and Geronimo could never talk to him again.

**62→63:** Instead of, as promised, offering to the community workshop a part of the huge ecological toilet seat market associated with the state program, the governor granted the exclusivity of the supply to one single private company in Mexico City. *(note: there is no real cause-effect relationship here, but rather two related facts occurring succesively)*

**63→58:** While the participation of the workshop in the state program could have spectacularly increased its activity, leading to the recruitment of several community members, its production gradually declined. Now, only one person works in the shop, orders have almost stopped, and dozens of toilet seats built with the hope of the governor’s promise, remain unsold.

**58→75:** For a time, San Luis Beltran was the focus of attention of state, national and international organisations. The community members of ‘the environmental village’, as it was labelled by the media, were involved in the development of the ecological toilet. In the workshop, people produced the toilet seats and trained state officials. The



community could identify itself with the 'dry toilets'. This technology might have brought some prosperity to the inhabitants if the state government had let them participate in its huge program. The population would have been more committed to demonstrating their successful alternative to the sewer system. But since the state authorities abandoned the case of San Luis Beltran's workshop, the population started to lose its dedication to the ecological toilet, and favoured the adoption of the sewer project.

**75:** c.f. section 6.2.

Box 4.73. Deception of state authorities causes disillusionment in the community workshop

*G: 'Yes, one day, they invited him [the governor of the state of Oaxaca] to San Luis for lunch, but they did not prepare the lunch in the agency, but in my house. The community leader asked me: 'Would you lend your house to prepare lunch for the governor?' I answered 'If you believe it can be useful, well here it is all yours'. So judicial agents and the governor's committee came to take a look, they looked at other houses, but they liked it here. And this is where it occurred. And I took this opportunity to write a letter to the governor, where I mentioned that we wanted sources of employment here in San Luis, work for many persons, apart from our organisation we have [the toilet seats workshop]. Because besides, women and children can do that work, it is not heavy work. So I said this in the letter, and as he sat down, I presented him the letter. He opened it and started to study it. [He said:] 'You've got your workshop here?' - 'Yes', I said, - 'And where is the workshop?', - 'There, behind the house, here is the galley, here is the workshop', - 'Can I take a look?', 'Yes, governor, yes you can pass'. So we took a look with him, I showed him the casts, the toilet seats we had there, the urinals... 'This is very good', he says, and he tells his assistant: 'Take note of this, support these people so that it grows, so that there is some work for the people, as you say in your letter'. - 'Yes, that's it Sir governor', - 'That is very good', he says, - 'I'm going to help you tomorrow', the assistant said - 'thank you Sir'. His assistant tells me: 'come tomorrow at 10am, to see what we can do. I was happy and I said to my friends: 'let's go, because...''*

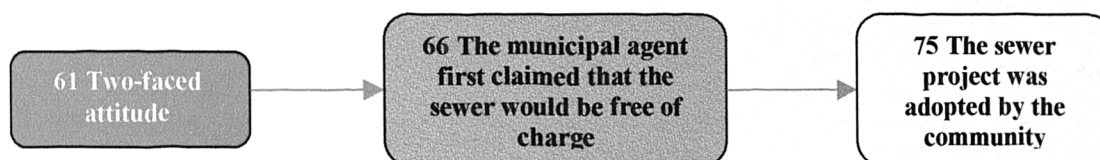
*J: 'This is the opportunity!'*

*G: 'So we go at 10 in the morning. What for? He [the governor's assistant] did not pay any attention to us. We came: 'Sir, here we are', - 'Wait a short moment, please, because I have a appointment now', so we keep standing and sitting, waiting and finally we talk to him: 'Can you pay attention to us?', - 'Yes, come tomorrow at 11am, because now I can't, I've got too much work.' [...] The next day we came. What for?: - 'He is in a meeting, he cannot take care of you, come back tomorrow.' 'Aïe, aïe' [...] We finally got tired of these: 'Come back tomorrow', 'Figure out that he just left', 'He's not here, he's not going to be here until that day' [...] He saw the workshop. He promised to help us, but he never did.'*

*I asked Alfonso about the activity of the workshop during the 'good old days', a few years ago. He told me there was work for five or six men and for a few women who were giving a final touch to the urinals. There were 12 casts to make the ecological toilets and it was possible to make two cement toilet seats or five resin seats per cast per day. Demand was not continuous, usually they had work for several weeks, up to two months, and then the demand would stop. Up to 20 persons thought about forming a small firm to produce more ecological toilet seats. This could have been a major source of employment and income for the community.*

*When I mentioned the name of the Anfora firm, Alfonso looked at me and told me that these rich people really dashed the hopes of the people from San Luis Beltran, because they could supply much more and their workshop could not be competitive. He added that the firm gave money to the government to obtain the market. It was good business both for government officials and for Anfora. I was wondering if people would have supported the idea of the sewer system if the community had had its own ecological toilets firm. He answered: 'Claro que, no, mataria dos pajaros con la misma piedra', which literally means, 'Of course not, we'd kill two birds with the same stone', meaning that using the sewer would be nonsense. They would contaminate more and they would be incoherent by promoting ecological toilets without using them at home. SI3- Alfonso Perez*

#### 6.7. Concepts 61, 66, 75



**61:** c.f. section 6.6. **75:** c.f. section 6.2.

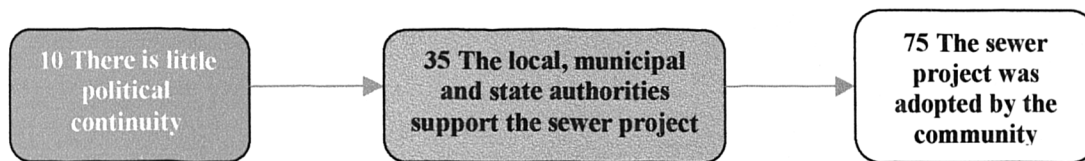
**61→66:** Although the community leader had no proof of it, he claimed that the sewer would be free and then asked for increasing levels of financial contribution.

**66→75:** When the municipal agent (the community leader) proposed the sewer project to the population in an assembly, he claimed that the project would be free of charge for the community members. This encouraged many people to vote for the project, imagining that they would get this service completely free.

**Box 4.74. People lured by the promise of a free sewer system**

*'The municipal president did not want this sewer to be built but some departments of the government offered it to the community. They pretended that it would be free. The municipal agent of the community believed it and the people voted to get it because they said: 'why refuse something that they give us?' ' SI11- Geronimo Perez No.1&2*

*'But as you say, how did they manage to put in their brain the idea of the sewer? Well, first they said that they would do it free, that we wouldn't have to pay anything. When the machinery came, excavating the streets, they said: 'You will give a contribution'. I wasn't here, my wife was just telling me [by telephone]. I told her: 'Be careful because this sewer is not going to be free, it is going to cost! Have they already said how much it is going to be?'. - 'No, they just said we'll have to contribute.'. When they were about to finish it [they said:] 'We'll pay for it'. Thus, I don't know why the government, or the people responsible for the program, why don't they tell us the truth?: 'We'll do that but it is going to cost you this!!' SI2- Agustin Bautista Lopez*

**6.8. Concepts 10, 35, 75**


**10:** c.f. section 3.1.

**10→35:** Political continuity would have probably led to further development of the ecological toilet technology in the community, with extra follow-up and improvements. Lack of political continuity was manifest in the way the local, municipal and state authorities managed the sanitation issue in San Luis Beltran. The first part of the sewer system was financed by the state government, which once offered credit payment facilities to 35 inhabitants to build the first ecological toilets. A second section of the network was funded by the municipal government, which had financed some 140 ecological toilets six years before. The community leader accepted the idea of the sewer project, contrary to all his predecessors.

**35→75:** Failure to keep up a long-term vision led the local, municipal, and state authorities to support the sewer system project, which encouraged the population to choose this option.

**75:** c.f. section 6.2.



## 6.9. Concepts 75, 80, 81, 82



**80:** At all levels of Mexican politics, from community councils to the state and federal governments, people tend to focus on the immediate requirements of a situation and fail to address problems in the long-term (c.f. the ‘El Mirador’ case study Box 4.12 and Box 4.17).

## Box 4.75. Short-term planning

*‘What happens is that the planning needs to be preventive, and here in Mexico, it is the opposite: we run after the thief, the police follows the thief, the police never wait for him, this is what happens in Mexico, especially in our villages. The population settles and the government come to mark the streets, and then they bring electricity, water. But first the people settled in an irregular way, and this logically causes social instability, physical problems, and this is why we have critical issues when a hurricane, or an earthquake happen. Because it is not planned. To plan is to have an idea about the future, it is to foresee. [...] We are always correcting, correcting. [...]’ SI4- Armando Ramirez*

**80→82:** People do not seem very worried about the possible lack of domestic water due to the use of the sewer system. Though they are aware of its likelihood, they reassure themselves by thinking that they will find a way to solve the water scarcity issue when it becomes critical.

**82→75:** This lack of concern about the implications of the sewer in terms of water scarcity led a majority of the community present at the assembly to approve the sewer project.

**80→81:** Similarly, very few people are concerned about the fact that the abandonment of their on-site sanitation systems for the sewer may entail municipal wastewater treatment taxes in the medium or long-term.

**81→75:** Failure to consider seriously the likelihood of future additional wastewater treatment costs facilitated the acceptance of the sewer project.

**75:** c.f. section 6.2.

Box 4.76. Short term planning and the uncertainty of tomorrow's water supply

*According to a study undertaken by the municipal civil engineering department, the use of the sewer should only be restricted to wastewater discharges. But ADOSAPACO is the organisation that will operate it, and they will not enforce the recommendations of the study. Of course I feel a little bit anxious about the future, but it is not going to happen right now, maybe in 10 years. And we've already managed to overcome situations of water crisis in the past without the sewer, so we should be able to overcome it with the sewer system. This is an issue that needs to be solved at family level and at community level. But of course, there will be problems because the population growth cannot stop. SI6- Enrique Bautista*

*'Yes, well this is a recommendation, ok? You know, inside the houses, it is difficult ...[to check that this is implemented by the people]. The recommendation was that during the dry season, people should desist from using their cistern toilet, or if not possible, that they should buy water from cistern trucks, or I don't know...' SI8- Francisco Pacheco*

*Q: 'Do you think there will be enough water for the sewer and for the other domestic uses?'*

*- 'Who knows? We haven't lacked water for 3 years. Maybe the water will be less with the use of the sewer. But most people think about keeping the ecological toilet for times of water scarcity. The cistern toilet is more for the guests.' (Saul Melchior Acevedo, 25)*

*- 'Yes, because we have an extra cistern that we use as a safety reserve.' (Alicia Mecinas Rodriguez, 38)*

*- 'It is going to be a little bit difficult because there is little water, and logically, everybody will want the cistern toilet. That is when the problems will start.' (Argimino Baragan Reyes, 47)*

*- 'I think that it is going to be difficult because there is little water. We share it with Donaji and we have to get up at night to get the water. We'll need a cistern.' (Eva Hernandez, 50)*

## **7. Conclusion**

Due to geological conditions, no groundwater supply can be envisaged in San Luis Beltran and the community relies almost completely on the Grande River, whose flow declines considerably during the dry season. Population growth and farmers put pressure on the limited amount of water available.

The ecological toilet sanitation system initially produced much enthusiasm in San Luis Beltran. The community leaders opposed the idea of the sewer and the municipality did not support much the community. As a result, people did not expect the sewer system. The ecological toilet represented a significant improvement to basic pit latrines or open-air defecation, and the fact that it does not require water to operate was also regarded as an advantage. The adoption of the ecological toilet by most of the community was fostered by a successful pilot project in the village.

However, this enthusiasm gradually declined during the late 90s. The activity community workshop producing ecological toilet seats almost stopped, as the state governor, who had promised his help to the workshop owner, granted the entire ecological toilet seat market to a private firm in Mexico City. Besides, ecological toilets are not very practical for children. In many cases, they are not operated optimally, and the resulting stench inconveniences the neighbourhood. The proximity of the city and professional diversification change people's way of life and their expectations. Less and less people make use of the compost. The ecological toilet is seen as a facility for the poor, while the sewer system represents modernity.

The adoption of the sewer project was controversial. Indeed, water is scarce, and many inhabitants are not connected to the water supply network and will not benefit from the sewer. Besides, due to high political turnover, the water committee has little knowledge of the local water resources and no study has been undertaken to assess the impact of the sewer system on water availability. The increasing proximity of the city, professional diversification (fostered by NAFTA and the urbanisation), and immigration have challenged the traditional values and weakened the local government. The low participation of the inhabitants in the community assemblies and the cultural gap between some groups of the community (old vs. young generations, natives vs.



newcomers) made it tough to reach a consensus about the sewer project. The community leader told the people that the sewer project would be free, and the issue of future wastewater treatment costs was not addressed. The project was finally voted for by the community.

Due to this controversy and to the defects of the sewer system, many community members do not want to contribute to the project. None of the public bodies successively involved in the sewer project feel accountable for the construction defects. The situation is not regarded as urgent by most of the people because they have alternative sanitation facilities. The sewer committee put little effort to solve the problem and the new community leader does not bother to complete a project that he did not launch.

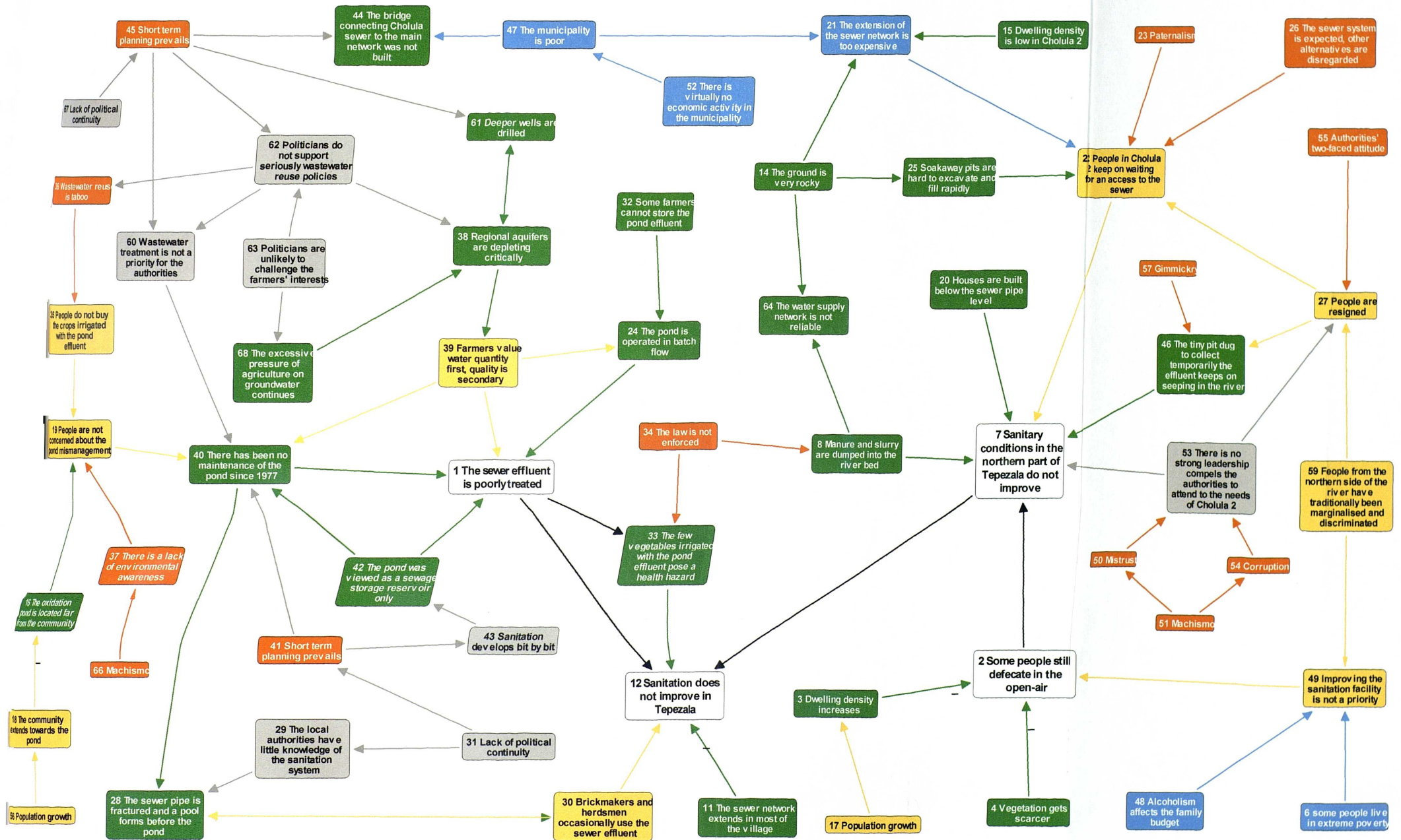
## D. The Tepezalá case study

### 1. Introduction

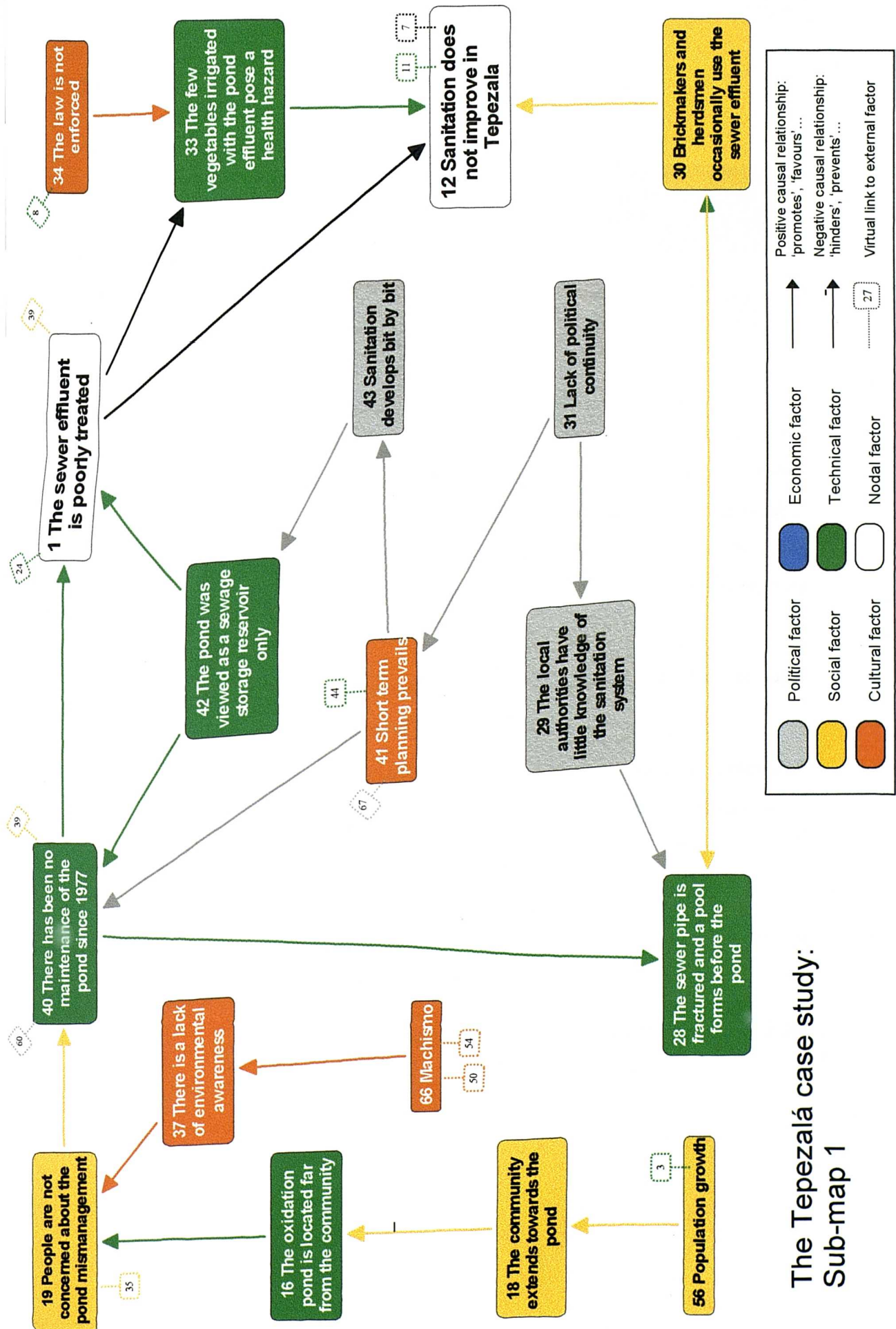
The results presented in this section relate to the work undertaken in Tepezalá between November 1999 and April 2000. Tepezalá, a rural community of about 3500 inhabitants, is the sit of one of the 18 municipal councils of Aguascalientes state, Central Mexico. Tepezalá is one of the two poorest municipalities of the state with hardly any economic activity. The development of the sanitation facilities is uneven through the village and three zones can be distinguished:

- The northern side of Tepezalá River comprises two districts, namely Cholula and Cholula 2. In every part of Tepezalá, the water supply is irregular, but it is especially true in this zone and for the large fraction of dwellings located uphill. Most of the houses of Cholula are connected to a sewer system. The sewer effluent is discharged in a little pit that was built as a temporary measure in the early 90s. The wastewater seeps from that pit into the riverbed, where children come to bathe during the rainy season.
- There is no sewer network installed in Cholula 2. *Open-air defecation, in the riverbed, in the backyards or uphill* is a common practise. Most of the existing sanitation facilities are very rudimentary. The population of Cholula 2 awaits the construction of the sewer system.

The central part of Tepezalá, comprising the town hall, the church, and the school, as well as the zone extending to the West alongside the river are the most developed areas of the village. The streets are paved with sidewalks planted with ornamental trees and most of the dwellings are connected to a sewer system independent from that of Cholula. The sewer effluent discharges in an oxidation pond. The efficiency of the wastewater treatment is very low, which exposes the four farmers who reuse the poorly treated wastewater to contamination risks. Besides, the sewer pipe is fractured before the pond and a pool has formed, which herdsman and brick-makers occasionally use.

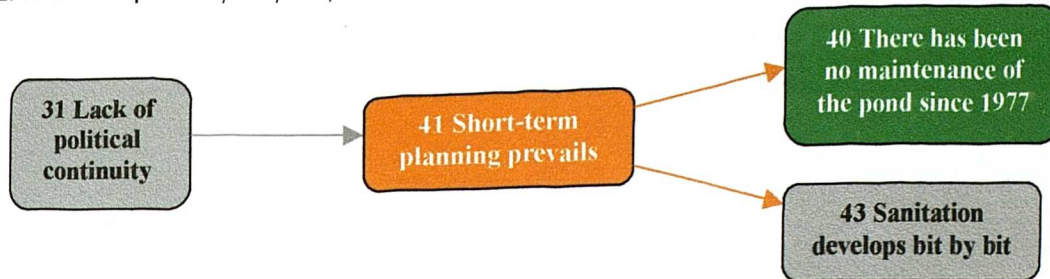






## 2. Sub-map 1

### 2.1. Concepts 31, 41, 40, 43



**31:** There is little political continuity in Mexico. The politicians know that their task is very temporary as their term of office is short (especially at municipal level: three years) and immediate re-eligibility is not permitted. Most of the people with a managerial post in the municipal or local government are replaced every three years. At the beginning of a new mandate, the government will tend to start everything from scratch again, disregarding what the previous team achieved (c.f. the San Luis Beltran case study Box 4.51.).

**31→41:** Lack of political continuity hinders medium to long-term planning. The focus is on the short term, that is, the duration of a term of office.

**41:** At all levels of Mexican politics, from the community council to the municipal, state and federal governments, people tend to focus on the immediate needs and fail to anticipate the future (c.f. the El Mirador case study Box 4.12. and Box 4.17.).

**41→40:** The oxidation pond has not been maintained since its construction in 1977, because the government that built it did not contemplate the requirements of the wastewater treatment system on a long-term basis.

**40:** The oxidation pond that receives the municipal domestic wastewater has not been maintained since it was built in 1997.



Box 4.77. Lack of political continuity and short-term planning

*The municipal presidents tend to think of what they can undertake within three years, without really considering the future of the municipality, without launching any medium or long-term programmes. Within the same political party there are usually different groups that influence the municipal president, so that he favours some particular localities. That way, he satisfies the interests of the people supporting him [in his party].* TII7- Municipal President

*'The pond wasn't maintained because the initial project did not mention anything about maintenance requirements, and nobody really paid attention to it until recently.'* TI2- Gutierrez (director of the municipal civil engineering department)

*San Antonio is a locality under the jurisdiction of Tepezalá municipality. The recently built oxidation pond was funded by the state and municipal authorities. According to the municipal town-planner, San Antonio's domestic effluent were discharged in the San Pedro river. San Pedro water catchment is considered an area of ecological interest. This is the main reason why the wastewater treatment system was built there. So far, nothing has been organised for the maintenance and operation of this oxidation pond. The government of Tepezalá is waiting for further indication from the state authorities.* TII6- Municipal town planner

**41→43:** Short-term planning results in 'bit by bit' sanitation development, as opposed to more integrated strategies analysing the needs for the long-term.

**43:** In Tepezalá, but more generally speaking at state and federal levels, global sanitation schemes are achieved step by step, without a complete vision of the whole picture and according to the priorities of each new governments.

Box 4.78. Bit by bit sanitation development in Tepezalá

*In 1977, Aguascalientes state started a sanitation programme. The objective was to remove the sources of faecal contamination from the villages. The construction of a sewer system and an oxidation pond in Tepezalá partly met this objective.*

*23 years later, the sewer system is operational and additional pipes have been regularly laid to meet the population growth. However, 15% of the population is not connected to the sewer system yet (mainly due to construction impediments) and most of them will have to wait a long time before they can enjoy this public service. In addition, the oxidation pond has not been maintained: it is full of sludge and performs badly. The quality of the 'treated' effluent (c.f. Table 4.2.) is very far below the Mexican water quality standards for agricultural wastewater reuse (SEMARNAP 1996).*

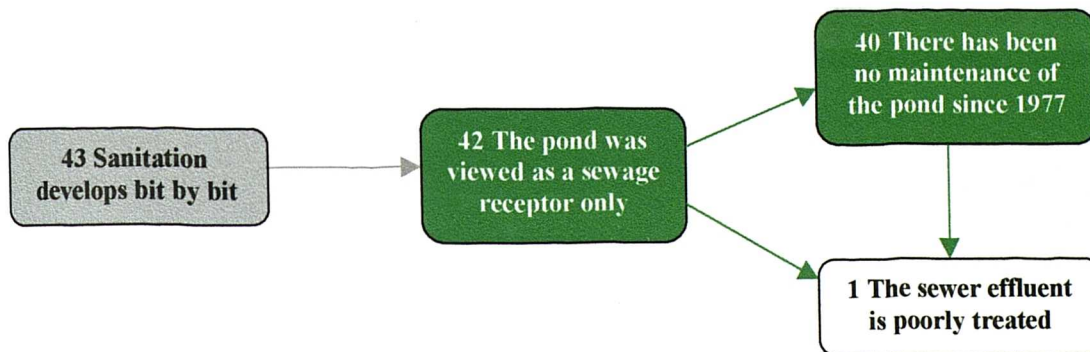
*The new director of CEAPA (state office for water supply and sanitation) and his team plan to build constructed wetlands in all the localities of more than 500 inhabitants. Tepezalá should then expect a new link of its sanitation infrastructure chain to be built.*

*The metaphor of the chain is particularly irrelevant in this case because 15% of the population (mainly in Cholula II, on the northern side of the river) do not experience satisfying hygiene conditions. Open-air defecation is common and black water is discharged*



*into the river. The first links of the chain are not safe and the whole chain becomes fragile. In other words, Tepezalá might get a constructed wetland built as secondary wastewater treatment plant, but pathogens are still released in the community environment through open-air defecation and black water discharges from dwellings. This kind of paradox would be less likely to occur within the context of a comprehensive sanitation programme.*

## 2.2. Concepts 43, 42, 40, 1



**43:** c.f. section 2.1.

**43→42:** Instead of developing a complete excreta collection-removal-treatment system, the state and municipal authorities built a sewer system and a pond that was not designed as a wastewater treatment system but rather as a receptor.

**42→40:** By defining the pond as a receiving body only, as opposed to a treatment system, the authorities allowed themselves to neglect the maintenance of the infrastructure.

**40:** c.f. section 2.1

**40→1:** Lack of maintenance of the oxidation pond for more than 20 years has considerably reduced the efficiency of the wastewater treatment.

**1:** The sewer effluent is poorly treated by the oxidation pond.

**Box 4.79. Lack of maintenance of the oxidation pond**
**Figure 4.25. Sludge accumulation in the oxidation pond**


Figure 4.25. shows the pond filled up with wastewater and on the right hand-side the accumulation of sludge at the inlet of the pond. This sludge accumulation impedes the even distribution of solid matter in the entire basin. Over the years, a thick layer of sludge has formed at the bottom of the pond. This means that the depth of water has decreased, the volume of the pond and the capacity of treatment is less.

Although people claim that the pond was only designed to receive the sewer effluent, the CNA (National Water Commission) refers to it as 'wastewater treatment system' (INEGI 1998). The pond could potentially operate as a facultative aerobic-anaerobic system. For the aerobic degradation processes to occur efficiently, the water surface needs to be aerated. The presence of bushes and trees on the banks prevents wind action on the water surface. Tepezalá is located in a quite windy area and the overall efficiency of the treatment would largely benefit from vegetation clearing. TR7- Tepezalá Sanitation & WW reuse

**42→1:** The pond was built in 1977 as part of a state sanitation program, which aim was principally to discharge the domestic water far away from the communities. Hence, the pond was only regarded as a receiving water body, and its design was not optimal for wastewater treatment. It was assumed that some farmers could benefit from this water, but there was no water quality standard for wastewater reuse in force at that time, and consequently no particular attention was paid to the treatment efficiency and to the uses of the 'treated' effluent.



#### Box 4.80. Wastewater treatment efficiency

The sewer and the pond effluents were sampled on the 15/11/99. On that day, the farmers were not emptying the pond and it was rather re-filling (the pond is operated in a batch-flow, c.f. section 3.5.). The samples were brought to CEAPA (state office for water supply and sanitation) water quality laboratory. The results of the analysis are presented in Table 4.2.

Table 4.2. Pond effluent quality

| Parameter                           | Sewer effluent<br>(3 samples<br>mean) | Pond effluent<br>(1 sample only) | Mexican norm for<br>agricultural wastewater<br>reuse NOM-001 |
|-------------------------------------|---------------------------------------|----------------------------------|--------------------------------------------------------------|
| EC ( $\mu\Omega$ /cm)               | 1938                                  | 1695                             |                                                              |
| COD (mg/L)                          | 1161                                  | 540                              |                                                              |
| BOD <sub>5</sub> (mg/L)             | 549                                   | 201                              | 75 (MM*) 150(DM*)                                            |
| NH <sub>3</sub> (mg/L)              | 85.9                                  | 50.5                             |                                                              |
| NO <sub>3</sub> <sup>-</sup> (mg/l) | 4.2                                   | 4.0                              |                                                              |
| FC (MPN/100mL)                      | $5.69 \times 10^7$                    | $8.8 \times 10^6$                | $1.10^3$ (MM) $2.10^3$ (DM)                                  |

\* MM: monthly mean, DM: daily mean

(Water Quality Lab, CEAPA, Aguascalientes, 23/11/99)(SEMARNAP 1996)

The electrical conductivity and the nitrate concentration do not seem to be significantly affected by the treatment. BOD (Biochemical Oxygen Demand) and nitrogen removal rates are respectively 64% and 41%. The concentration of faecal coliforms only decreases by 1 log<sub>10</sub> unit and is far above the level permitted by the Mexican norm.

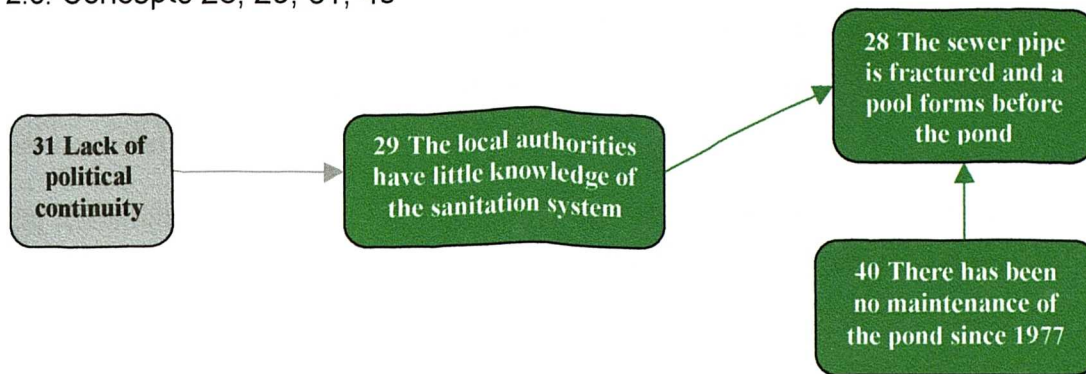
These results show that on the day it was sampled, the quality of the pond effluent was far below the Mexican agricultural wastewater reuse water quality norm. When the sample was taken, the pond outlet was closed but a small discharge occurred. The quality of the effluent probably worsens significantly when the pond is emptied, as the load of suspended matter increases. The quality of the effluent would presumably improve a lot if the pond were operated in a flow-through mode, allowing for a longer detention time. TR7- Tepezalá Sanitation & WW reuse

The pond has a potential volume of 1600m<sup>3</sup> and the estimated mean sewer discharge at the inlet of the pond is 3.5L.s<sup>-1</sup>. On average, the detention time of the wastewater in the pond is 5.3 days, which is far too little to significantly remove pathogens. A minimum of 60 days detention time is advocated for flow-through facultative ponds receiving untreated wastewater (Tchobanoglous and Burton 1991). These observations contrast with the opinion of CNA Aguascalientes's vice-director on the efficiency of the dozens of oxidation ponds operating throughout the state in similar conditions as in Tepezalá:

*Although they are not maintained, they work quite well and purify water to a certain level. They are designed for a 20 day detention time, which permit in theory the removal of 99%FC and 96%TSS and BOD. In reality, on average, they operates closer to 50-60%. One needs to understand that in any case, small communities do not have to pay for wastewater discharge. So we focus on large communities. [Tepezalá is legally not a small community] TI3-Rodriguez*



### 2.3. Concepts 28, 29, 31, 40



**31:** c.f. section 2.1.

**31→29:** The lack of political continuity at municipal level affects the management of water supply and sanitation, as many members of the municipal civil engineering department change with each new government. Thus, these professionals lack time to acquire a good knowledge of the municipal water and sanitation infrastructure and people's needs in different zones of the municipality.

#### Box 4.81. High political turnover affects the experience of the staff

*Benjamin has been working as a civil engineer for the municipality for more than twenty years now. He considers that the sewer discharge into the river (on the northern side of Tepezalá) is a serious issue and he is aware of the health implications related to it. However, he explains that he is not the one who makes the decisions. Most of the other people who work in his office are not aware of this issue (due to the director of the department having arrived with the government 18 months ago, and the other three engineers arrived less than a year ago). They did not know about this problem. TI7- Benjamin (Municipal civil engineer)*

*Sanitation projects need to be regarded as long-term projects, whose sustainability will depend on the good operation and maintenance of the system. The president agrees that the current political system (high turnover, centralisation of the power) does not favour continuity in such projects. He proposes the creation of a decentralised water-operating organisation to deal with all issues related to water supply and sanitation. This organisation should be composed of community members elected by the population, according to their skills and ability to hold such responsibilities. The organisation would then be autonomous, with public financing and legal power to take decisions. TR4- Stakeholder Analysis*

**29→28:** Most members of the civil engineering department of Tepezalá have never seen the oxidation pond, and maybe only two or three persons in the town hall are aware of the leakage in the sewer pipe before the pond. This partially explains why this issue was not regarded as serious and why the sewer pipe remains fractured.



**40→28:** The municipal authorities have shown no interest in maintaining the pond and keeping its surroundings in good conditions during the last 20 years. The same situation continues, which partially explains why the fractured sewer pipe before the pond has not been mended yet.

**28:** About 40 m before the sewer outlet into the pond, the pipe is cracked on its bottom side, resulting in a significant and continuous leakage, which creates a shallow pool of about 400m<sup>2</sup> and 20 to 50cm deep.

Box 4.82. Leakage of sewage forms a wastewater pool

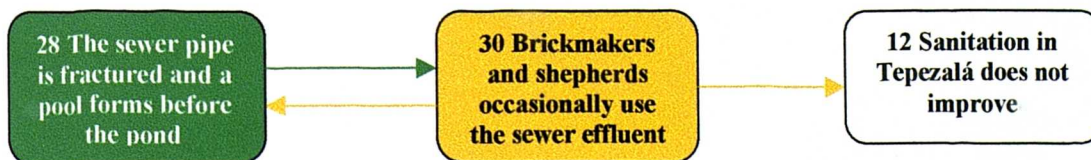
Figure 4.26. Wastewater pool before the pond



*This leakage and the pool it creates are clearly visible, the volume discharged is significant. Why were things left in this state? The director of the municipal civil engineering department admitted he had recently been aware of it and that they would need to mend it soon. According to several interviewees this leakage profit many people: herds of goats*

*occasionally drink this water and some community members sometimes make adobe bricks in this very area. The ejidal commissioner was preoccupied by the potential risks of using this water for this kind of activity. Considering that brick-making involves walking barefoot in this wastewater-soil sludge, the risks of contamination are multiple and significant. TR7-Tepezalá Sanitation & WW reuse*

2.4. Concepts 28, 30, 12



**28:** c.f. section 2.3.

**30:** The pool resulting from the sewer pipe leakage is sometimes used by shepherds, who bring their goats to drink the ‘settled’ wastewater when they can’t have access to

better sources. Occasionally, some brick-makers dig the soil and use the pool water to make adobe bricks.

**28↔30:** Brick makers and shepherds use the wastewater that leaks from the sewer pipe. The cause-effect relationship is not very clear here. It is actually likely that the sewer pipe was fractured by one of the beneficiaries. The local authorities do not condemn them. They consider the pool as a means of subsistence for these people who live in extreme poverty. This might also explain why the municipal government is not rushing to mend the fractured pipe.

**30→12:** The use of the pool wastewater has some potentially severe health implications for the herdsmen and the brick-makers. Trampling bare foot the wetted clay-loam soil to make adobe brick is associated with high risks of contamination. The persons infected can spread pathogens at home.

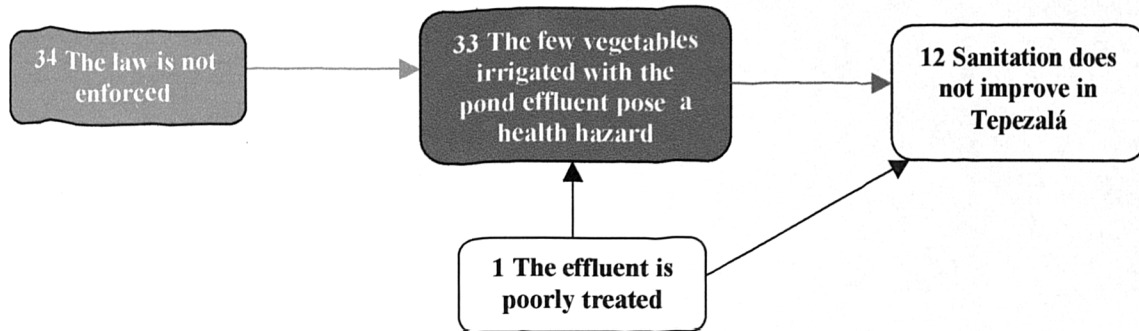
**12:** Sanitation does not improve in Tepezalá. The current state of development of the sanitation infrastructure (sanitation facilities, sewer system, and wastewater treatment) and hygiene behaviours do not favour greater sanitary conditions for the population.

#### Box 4.83. Waterborne pathogen cocktail for the goats

*'The problem of water is a very big problem for all of us. I need to go down the hill where the farmers irrigate with groundwater. They charge me a goat each time I bring my herd over there. When they sow, we have to look for other water sources, as they don't let us approach their parcels with the animals. The well down in the riverbed yields water of good quality but in very small quantity because it has been clogged with soil for two years. A big rainfall brought lot of sludge running off in the river bed and this is what caused the well to be less productive [another man, a ex-shepherd, reports that they all used to go to that well in the past]. Last week, I could not use the groundwater from the farmers' well, so I was forced to lead the goats to the pool before the pond. The goats do not drink wastewater unless they are very thirsty. Now, you see, I lost 15 goats last week, they all died in a few days because of this water. First they lose their hair, get weak and then die within a matter of three days. My brother leads his herd to the hill. There he has found a small well but it doesn't yield much and cannot satisfy another herd. Really, the wastewater is not a preferred source of water as the goats do not like it and die from it. TI6- Shepherd*



## 2.5. Concepts 1, 12, 33, 34



**1:** c.f. section 2.2.

**1→33:** The efficiency of pathogen removal in the oxidation pond does not guarantee the farmer a significant reduction of the health hazard associated with wastewater irrigation, when compared with irrigation with raw sewage.

**33:** Four farmers irrigate their crops with the pond effluent. They mainly grow maize, oat, and alfalfa, but occasionally vegetables, such as melons, watermelons, and courgettes. Considering the poor quality of the pond effluent, some health hazards are associated with these farming practices (e.g. contamination by helminth eggs).

**34:** Law enforcement in Mexico is poor, partly due to the weakness of the judicial system.

**34→33:** Members from the CNA in Aguascalientes acknowledge that it is forbidden to irrigate vegetables with the pond effluent. The failure to enforce the set of laws regulating wastewater reuse for agriculture leads to farming practices that are potentially hazardous for the four ejidatarios irrigating their parcels with the pond effluent.

### Box 4.84. Law enforcement in Mexico

*'Well, there is no payment culture! Besides, everybody believes that access to free water is a right, and they give up paying... But the same person that doesn't pay here, when he moves to California, he pays because the punitive system for those who don't pay is effective there. Here, there are no penalties, so...'* MI61 – J.Villalobos COPLADE

*The non-payment culture is indeed favoured by the low efficiency of the judicial and punitive systems. The level of law enforcement is far from being coercive, and it inevitably leads to big abuses. Bautista points out that in some cases the law cannot not be fully enforced because of 'compadrazgo' (literally: companionship) a well established phenomena in the Mexican*



society. For instance, owners of industries or hotels with big water bills to pay often obtain favours from friends who are well introduced in the local political arena (MI61 – A. Bautista CNA). Hernandez confirms that *compadrazgo* is not a negligible issue with respect to water charging in Oaxaca City and its metropolitan zone (MI62 – Hernandez, CNA). Lack of law enforcement is also manifest when the municipal and state governments do not pay their fines when charged for illegal wastewater discharges into rivers. MR10 – Regional Water & Wastewater

Supreme Court judges are appointed by the executive and rubber-stamped by the Senate. The judicial system is weak, politicised, and riddled with the corruption infecting all official bodies. In most rural areas, respect for laws by official agencies is nearly non-existent, and in general, lower courts and law enforcement are undermined by widespread bribery. (Freedomhouse.org 1999)

#### Box 4.85. Wastewater reuse for irrigation

Figure 4.27. The benefits of agricultural wastewater reuse

From left to right: Wastewater irrigated maize field, wastewater fed maize ears, rain-fed maize field.



Figure 4.27. shows the great benefits associated with irrigation with the pond effluent, when compared to rain-fed parcels. The yield increase and the users are guaranteed a harvest, which is not the case with rain-fed agriculture in periods of droughts. The gratuity of water is another major benefit. The pond effluent is characterised by a high electrical conductivity, which in the long-term, could threaten the soil fertility. There is no drainage of the soils to leach the accumulation of salts in the root zone. In the field, small deposits of white particles are observable in the furrows, which is probably a sign of on-going salinisation. The analysis of the effluent revealed a FC concentration of  $8.8 \times 10^6$ , which is really unsuitable for safe irrigation practices. The presence of helminths, viruses and other microbial pathogens was not assessed, but it is very likely that their removal-rate in the pond is very low. TR7- Tepezalá Sanitation & WW reuse

J: What are the consequences of this lack of efficiency for the population, for the environment?

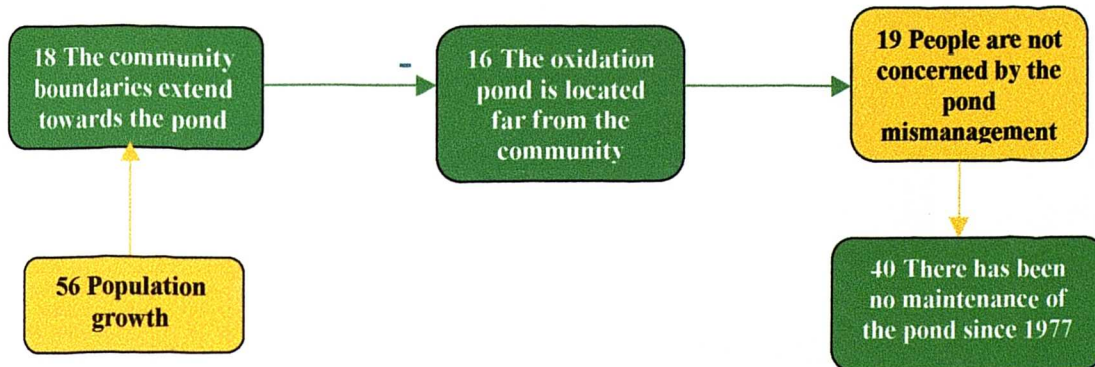
Jesus: There is discharge of toxic elements. People use this water for building bricks and to irrigate their parcels. In doing so they get in contact with the contaminants. Occasionally they can develop skin allergies or diseases, which can affect the people they live with. Thus, the whole population is more or less directly affected. TI17- Municipal President



**33→12:** The current farming practices with regard to wastewater reuse affect the improvement of sanitation in Tepezalá.

**1→12:** The very poor level of sewage treatment affects the sanitary conditions of the population through agricultural wastewater reuse.

## 2.6. Concepts 16, 18, 19, 40, 56



**56:** The population of the community has been increasing steadily during the last decades with a mean rate of more than 2% during the last five years.

**56→18:** The western part of Tepezalá, San Rafael, is getting more and more populated and new houses keep mushrooming towards the oxidation pond.

**18→19:** The extension of the community towards the West reduces the distance separating the population from the pond.

**16→19:** The oxidation pond and the fields irrigated with the ‘treated’ effluent are located far from the village (respectively 500m and 1km, approximately). Despite the extension of the community, this buffer zone remains large enough to ensure the population is not incommoded by the odours and mosquitoes of the pond and the effluent irrigated parcels. The pond is not fenced but people consider that there is no risk for the children because it is far from the community.

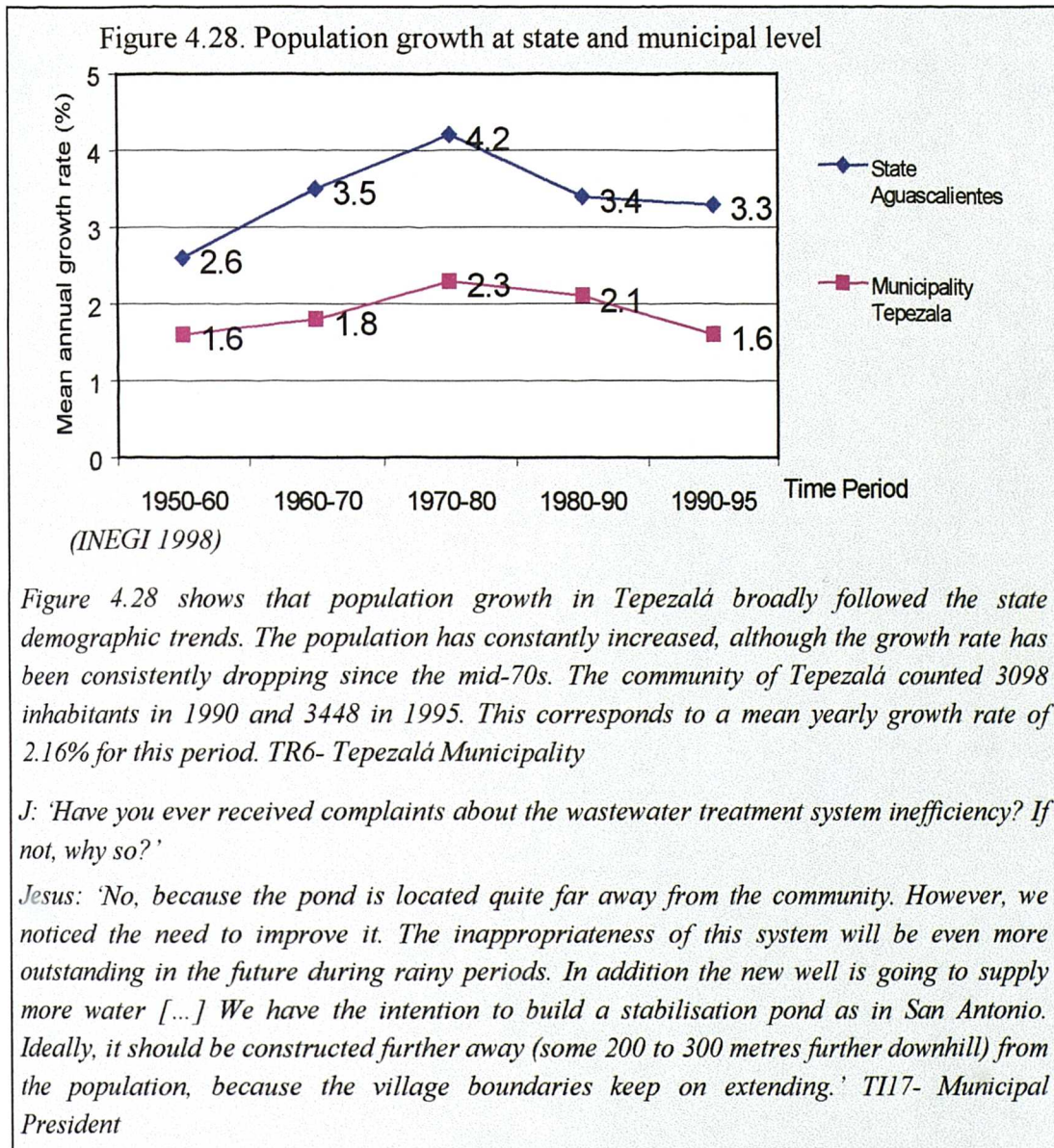
**19:** The great majority of the population does not feel much concerned about the lack of maintenance of the pond and by the neglectful way it is operated.



**19→40:** The lack of concern of the population about the quality of operation and maintenance of the community wastewater treatment system does not encourage the authorities to get more involved in this issue.

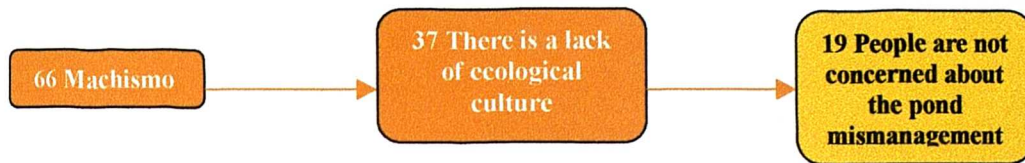
**40:** c.f. section 2.1.

Box 4.86. Community population grows and the distance to the pond shrinks





## 2.7. Concepts 66, 37, 19



**66:** Machismo is a fundamental cultural feature of the Mexican people, which determines the gender roles and the behaviours of people in society. The macho has to prove his strength and invulnerability and he becomes a hermetic person outside his home. The woman is merely regarded as a function, an instrument that has to bring harmony, order and pity in the family. With her daughter(s), she cleans the house and sweeps the litter that men drop on the floor.

**66→37:** Machismo dissuades the males from being involved in promoting hygiene at home. These duties belong to the realm of the women, and men would be lowering themselves by undertaking these domestic tasks. In society, the macho drops litter on the street and does not bother looking for a dustbin. In this respect, machismo tends to promote a neglectful attitude towards the environment.

**37→19:** There is a lack of ecological culture in Mexico combined with a certain cynicism. The norm is to drop the litter in the street rather than to dispose of it in the dustbins. Thus, most of the population is neither bothered nor surprised to see that the pond is not maintained at all and that its banks are covered with litter.

### Box 4.87. Machismo and the care for the environment

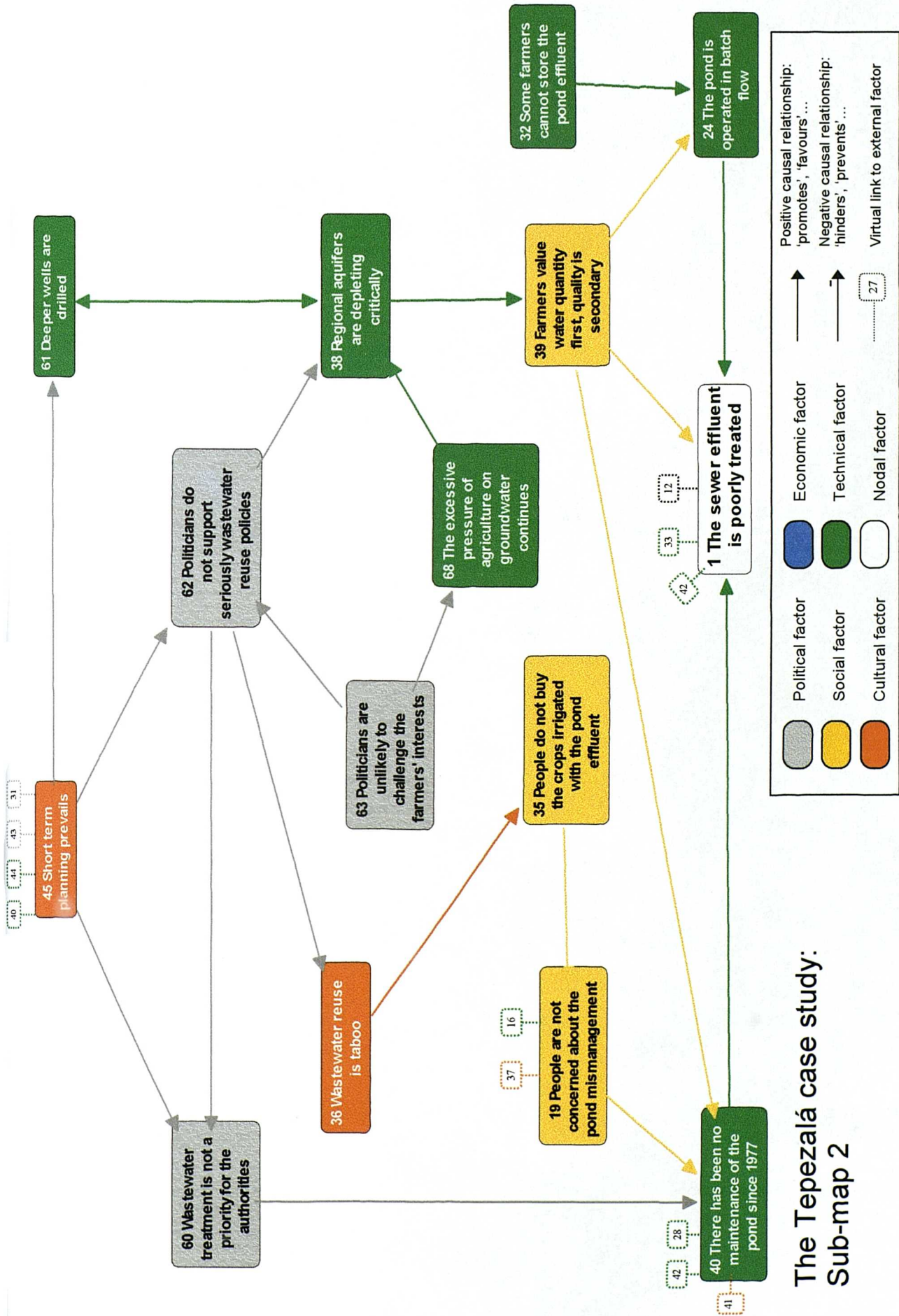
*'The 'macho' is an hermetic being, enclosed in himself, able to keep himself and keep what is being entrusted. Manliness is measured by the invulnerability to the enemy weapons or to the impacts of the outer world. Stoicism is the highest of our waringly and politic virtues. Our history is full of sentences and episodes that reveal the indifference of our heroes in front of pain and danger. From the childhood on, we are taught how to suffer with dignity the defeats, a conception that does not lack greatness.'* (Paz 1985)

*'The man and the children get relieved of all their responsibilities and worries and they let the woman be in charge of all these things that they should do and worry about. The woman has to do the cooking but the others do not even know if there is food and if there is going to be dinner... She has to find the way to feed them all. Similarly, she is responsible for the cleaning, and the children believe that it is part of her obligations. However, the model most children follow is that of the father, that is, they try to behave like him. And he does whatever he wants in the house, he can drop litter anywhere, he can beat the woman...he does not have to clean anything. T111- Josefina Muñoz Nuñez (Director of the municipal health centre)*

*'Mexicans seemed to go through a miraculous transfiguration when they crossed the border. 'As soon as we cross the line, we Mexicans change our behaviour: We immediately secure our seat belts and stop throwing papers out the window,' Garcia Encinas said.'* (Oppenheimer 1996)

*'People can start worrying about the environment when they have enough to eat. Mexico had its environmental law in 1992, and Aguascalientes state had its own just recently. The education has been adopting and teaching environmental topics for less than 12 years, which can explain some of the behaviours.'* T114- Eugenio Murillo Colín (Director of SEMARNAP, Aguascalientes state)

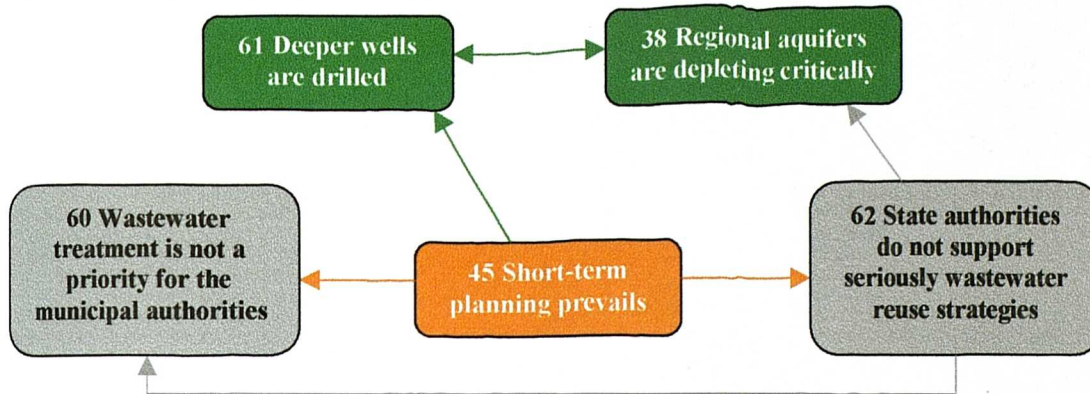






### 3. Sub-map 2

#### 3.1. Concepts 45, 60, 61, 62, 38



**38:** The depletion of the groundwater resources of the state of Aguascalientes has become a major social, economic and political issue. The negative water balance is worsening year after year: urbanisation threatens the zones of natural groundwater recharge and the demand increases as population grows.

#### Box 4.88. Groundwater depletion: technical and political aspects

The level of groundwater extraction reaches 483 millions m<sup>3</sup> per year and is mainly directed to crop irrigation (89%). There is an estimated annual groundwater deficit of 280Mm<sup>3</sup> in 1985 (INEGI 1993). The most recent estimations indicate that in Aguascalientes City the water table level drops from 2-3 m per year, with a mean piezometric level standing at a depth of about 185m (Rodriguez, Hernandez *et al.* 1999).

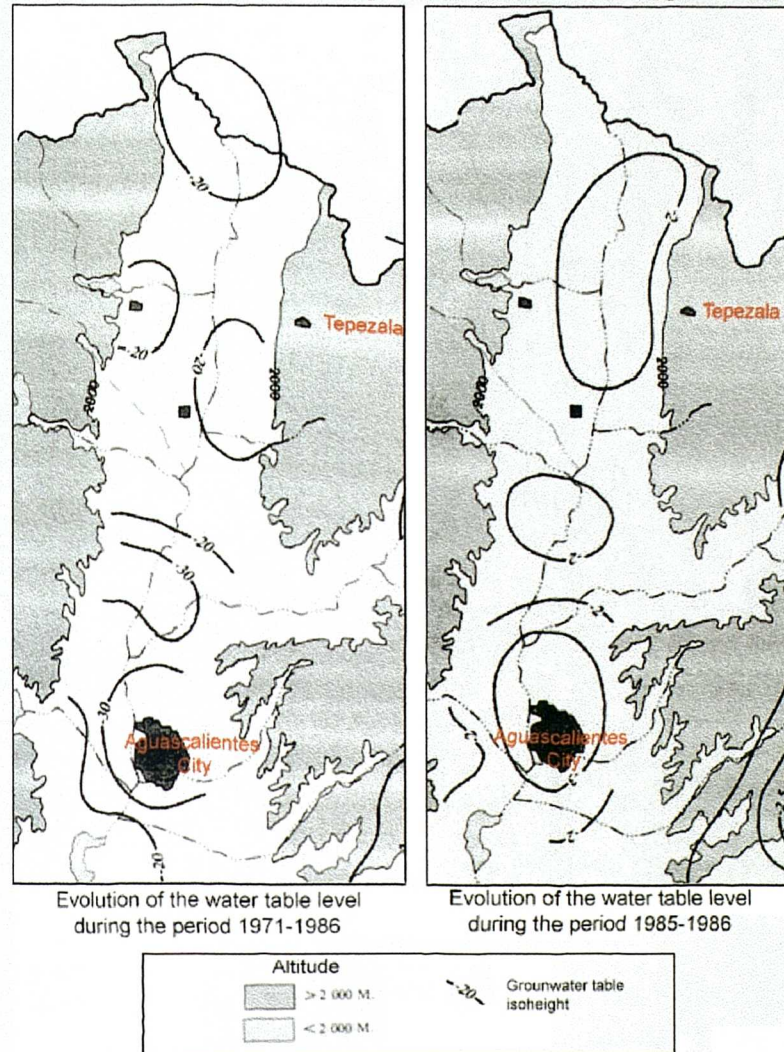
A study presented during the 2nd National Groundwater Congress in Aguascalientes (November 1999) emphasised the emergency nature of the situation in the state of Aguascalientes. Simulations ran with the model MASAGUAS predict a drop of the water table level in the range of 50 to 80m in 2015 under the current groundwater extraction level, with severe economical and health implications (Lagny and Escobedo 1999). Indeed, as deeper wells are exploited, thermal geological zones are reached, and the water drawn presents high mineral concentrations. Some wells already supply water with fluorides concentrations up to 2-9mg/L, while the international standard specifies a maximum of 1.5mg/L (Rodriguez, Hernandez *et al.* 1999).

The groundwater deficit was estimated to be 133 Mm<sup>3</sup> in 1985. To reach an equilibrium state, groundwater extraction must now be reduced by 280Mm<sup>3</sup>/year. This implies that the agricultural sector reduces its water consumption to 45% of its level of 1995. This can be achieved by the improvement of irrigation practices, the selection of appropriate crops, and in ultimate recourse by the reduction of the irrigated surfaces (Lagny and Escobedo 1999).

*So far, the state policy does not integrate a proper set of laws regulating groundwater extraction. Where wells are in operation (with or without legal permit) water is taken for granted. Its availability is mainly limited by the well depth and the pumping equipment installed, and its cost is essentially related to the energy consumed.*



Figure 4.29. Groundwater depletion in the state of Aguascalientes



As shown on Figure 4.29 (left hand-side), the groundwater table level dropped from 20m during the period 1971-1986 in the area of Tepezalá municipality.

The map on the right hand-side shows that the groundwater table level dropped from 2m in the western part of the municipality between 1985 and 1986.

In 1987 the piezometric levels ranged from 80m in the eastern part of the municipality to 40m in the western area (INEGI 1987) (INEGI 1993).

Adapted from 'Dinamica de los niveles del agua subterranea entre 1971 y 1986' and 'Dinamica del nivel del agua subterranea entre 1985 y 1986' (INEGI 1987)

'We've just finished some studies about that [groundwater resources]: more than a hundred aquifers among the most important [of the country] are totally over-exploited. There is no recharge capacity. And in the urban zones, institutional and political issues are key aspects of all the water management issues. In other words, the fact that everything is managed at the municipal level by a president that is elected for three years (without immediate re-eligibility) does not incite to launch medium or long term project. Thus, when a municipal president leaves, the new one arrives and undo what's been achieved previously.' SI35 - Olivier Lafourcade (Director of the World Bank for the region Central America and the Caribbean)

45: c.f. concept 41 section 2.1.



**45→61:** Trying to solve the critical regional water crisis requires the implementation of rather austere strategies implemented in the long-term. However, politics in Mexico favour short-term projects that can fit into a single term of office. Thus, instead of facing the real causes of groundwater depletion (i.e. groundwater over-exploitation by the agriculture), the state government relocates or deepens the exhausted wells. In Tepezalá, a new well was recently drilled to supply more water to the community. Indeed, the population living in the highest part of the village has been experiencing more and more water shortages.

**61↔38:** The depletion of the regional aquifers leads the authorities to drill deeper wells in order to meet the domestic requirements of a growing population. Conversely, drilling new wells and deepening the existing ones accentuate the depletion of groundwater resources.

**45→62:** Wastewater reuse is a good means of putting less pressure on groundwater. Supporting wastewater reuse strategies implies developing wastewater treatment plants and promoting new farming practices. These strategies need to be sustained for a long period of time. However, due to lack of political continuity, the state authorities essentially launch short to medium-term projects, which has prevented the promotion of wastewater reuse practices so far.

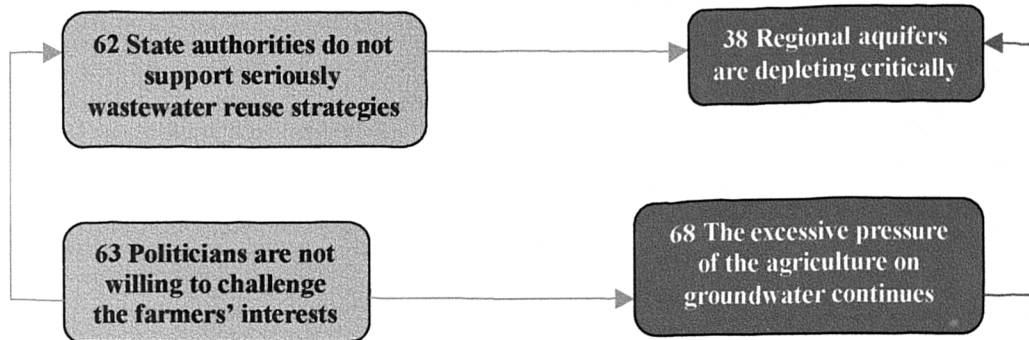
**62:** State authorities do not seriously support wastewater reuse strategies.

**62→38:** Failure to undertake wastewater reuse programs at state level exacerbates the on-going depletion of the regional groundwater resources.

**45→60:** This phenomenon is also manifest at municipal level: the short duration of the terms of office (three years, no immediate re-eligibility) tends to shorten the lifetime of projects. Partly for this reason, wastewater reuse projects are not a priority for Tepezalá municipality.

**62→60:** Lack of strong support from the state authorities to implement wastewater reuse strategies discourages the municipalities to venture alone on such long-term projects.

### 3.2. Concepts 38, 62, 63, 68



**63→68:** There is no real political willingness to take effective measures to control the over-exploitation of the regional aquifers by the farming sector. As a result, the excessive pressure of agriculture on groundwater resources continues.

#### Box 4.89. No real political willingness to address the main factors of the water crisis

*'There is very low water use efficiency in the agriculture. The farmers just pay the electricity. Reforms in the national legislation are required and Aguascalientes is one of the states that are trying to impulse this change. There are lobbies and the government is afraid to face the social pressures that would result from such reforms. Actually, most of these farmers have little resources and the reforms would have major consequences for them, so that they would round on the government. This is the same problem with electricity: farmers only pay \$0.15-0.18/KW while everybody else, including the industrial users, pays \$0.35/KW. So, farmers enjoy very favourable conditions. One can assume that this aims to limit rural exodus and to keep Mexico self-reliant on the [international] food market. It is a national policy.'* TI3-Rodriguez (CNA Aguascalientes vice-director)

*'There are programs aiming to gain efficiency in agricultural water use. CNA (National Water Commission) has got a 'Efficient Use of Water and Electricity' program. It is mainly directed to farmers so that it is carried out with the state agriculture office. The farmer invests 25%, the state 25%, and CNA 50%, for instance. CNA checks the water abstraction system. If it works under 60% efficiency, then the program is launched [...] However, of course, it all depends on the financial capacity of the farmers to invest 25%.'* TI3-Villegas Romo (CNA Rural programs and Social Participation)

*O: 'Considering the over-exploitation issue, there are two aspects. First of all, the agricultural water use: if you sum up all the aquifers, almost 80% of the water pumped in Mexico is used by the agriculture. With a lot of over-exploitation in many places...*

*J: 'Without any real political willingness to...'*

*O: 'No real political willingness...with, in addition, which is dramatic, economic policies that foster over-exploitation. The cost of water is far below its normal value, and then there are subsidies and incentives, notably on the energy price, so this is an encouragement to pump, because it costs you nothing...'*

*J: 'Yes, they have preferential tariffs...'*

*O: 'The energy tariffs for the agriculture is a real scandal. That is why there is such a big over-exploitation in this sector.'*

*SI35 - Olivier Lafourcade (Director of the World Bank for the region Central America and the Caribbean)*

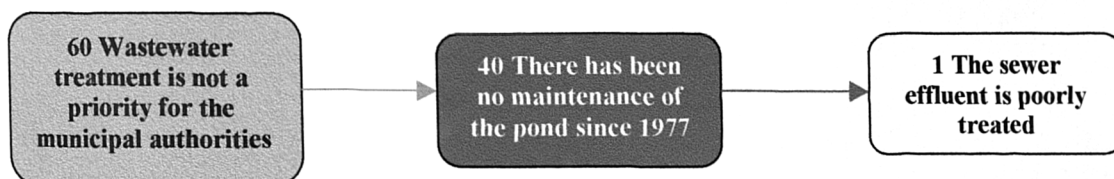
**68→38:** In 1985, 89% of the groundwater extracted in the state of Aguascalientes was used by the agriculture (INEGI 1993). Though this figure might have slightly changed during the last 15 years, the combination of obsolete irrigation systems with farming production irrelevant to the arid environment (i.e. dairy farms with large areas of irrigated alfalfa) maintains an excessive pressure on the rapidly depleting aquifers.

**38:** c.f. section 3.1.

**63→62:** The state authorities have not endeavoured to deal seriously with the main cause of the water crisis, the agriculture sector. Despite the campaigns of promotion for efficient irrigation systems, the farming practices have little changed, and the authorities have not dared getting seriously involved in wastewater reuse strategies.

**62→38:** c.f. section 3.1.

### 3.3. Concepts 60, 40, 1



**60:** c.f. section 3.1.

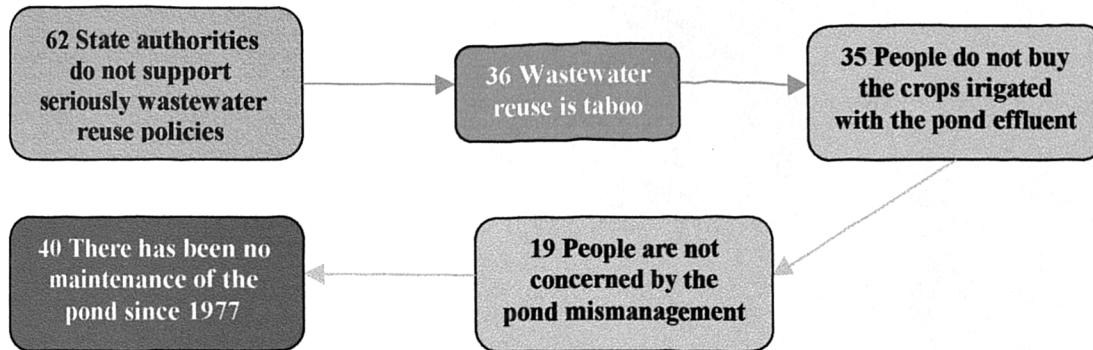
**60→40:** Relative disinterest of the municipal authorities in wastewater treatment and wastewater reuse issues partly explains the lack of maintenance of the oxidation pond.

**40:** c.f. section 2.1.

**40→1:** c.f. section 2.2.



### 3.4. Concepts 62, 36, 35, 19, 40



**62:** c.f. section 3.1.

**36:** Wastewater reuse is a taboo issue. There is a lack of information on contamination routes and about the safety of practising restricted irrigation with an effluent of a certain quality. Many people still believe that ‘dirty things’ (pathogens from faeces) are absorbed by the plants and routed up to the maize grains.

**62→36:** Lack of information and education campaign from the state authorities on safe wastewater reuse practices maintains the issue as a taboo.

#### Box 4.90. How people perceive the products irrigated with the pond effluent

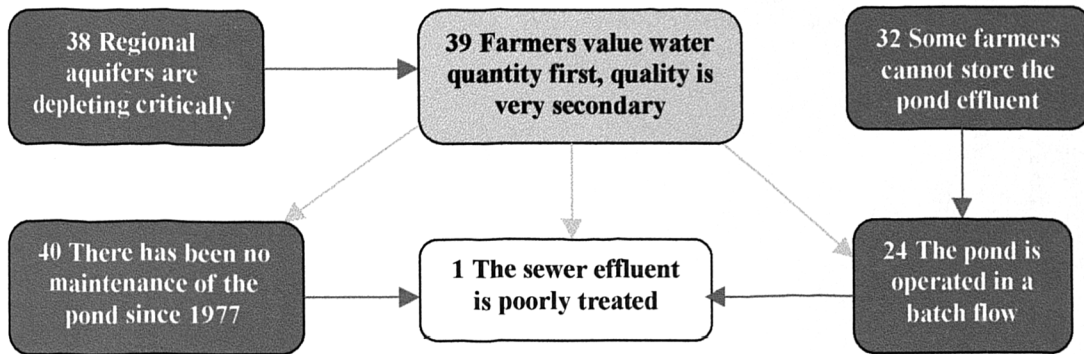
*74% of the 23 interviewees think that the crops irrigated with the pond effluent are not good for human consumption. However, 91% of the sampled population believe that they would possibly buy these products if they were irrigated with water of a better quality (through improvement of the wastewater treatment system). 75% of the interviewees are aware of the contamination risks related to the consumption of vegetables irrigated with sewage. However, several persons reckoned that they have no means to check how the vegetables that they buy at the marketplace or in the village shop were irrigated. People seem ready to change their perceptions and behaviour providing they are informed and insured that the consumption of raw products irrigated with treated wastewater can be healthy. TS1- Cholula Survey*

**36→35:** People are very mistrustful of the crops irrigated with the pond effluent. Except for some relatives of the farmers, people do not buy these products (mainly maize and beans).

**35→19:** People do not feel much concerned about the low efficiency and the lack of maintenance of the wastewater treatment system because they do not buy the products irrigated with the ‘treated’ effluent

**19→40:** c.f. section 2.6.

### 3.5. Concepts 1, 24, 32, 38, 39, 40



**38:** c.f. section 3.1.

**38→39:** In a context of severe water scarcity, the farmers are not really fussy about the quality of the water they use for irrigation. What primarily matters for them is to have as much water as possible to irrigate the largest area they can.

**39→40:** The farmers who irrigate with the pond effluent are not really concerned about maintenance of the pond because they do not really worry about the effluent quality. Except for a time when they all got together to mend a bank that was collapsing after heavy rainfall, the farmers have not maintained the pond and have not requested the municipal authorities to do so.

**40→1:** c.f. section 2.2.

**39→1:** The lack of interest of the farmers in improving the quality of the pond effluent contribute to keep the wastewater treatment system operating at a very low efficiency, discharging an effluent of poor quality.

**32→24:** Only one out of the four farmers reusing wastewater owns an earthen basin to store the pond effluent. The others can not put aside water and to choose when to irrigate their field. Thus, instead of allowing the pond to operate continuously with a constant discharge, the farmers operate it in a batch flow fashion so that they can flood their parcels.

Figure 4.30. Basin used for storage of the pond effluent



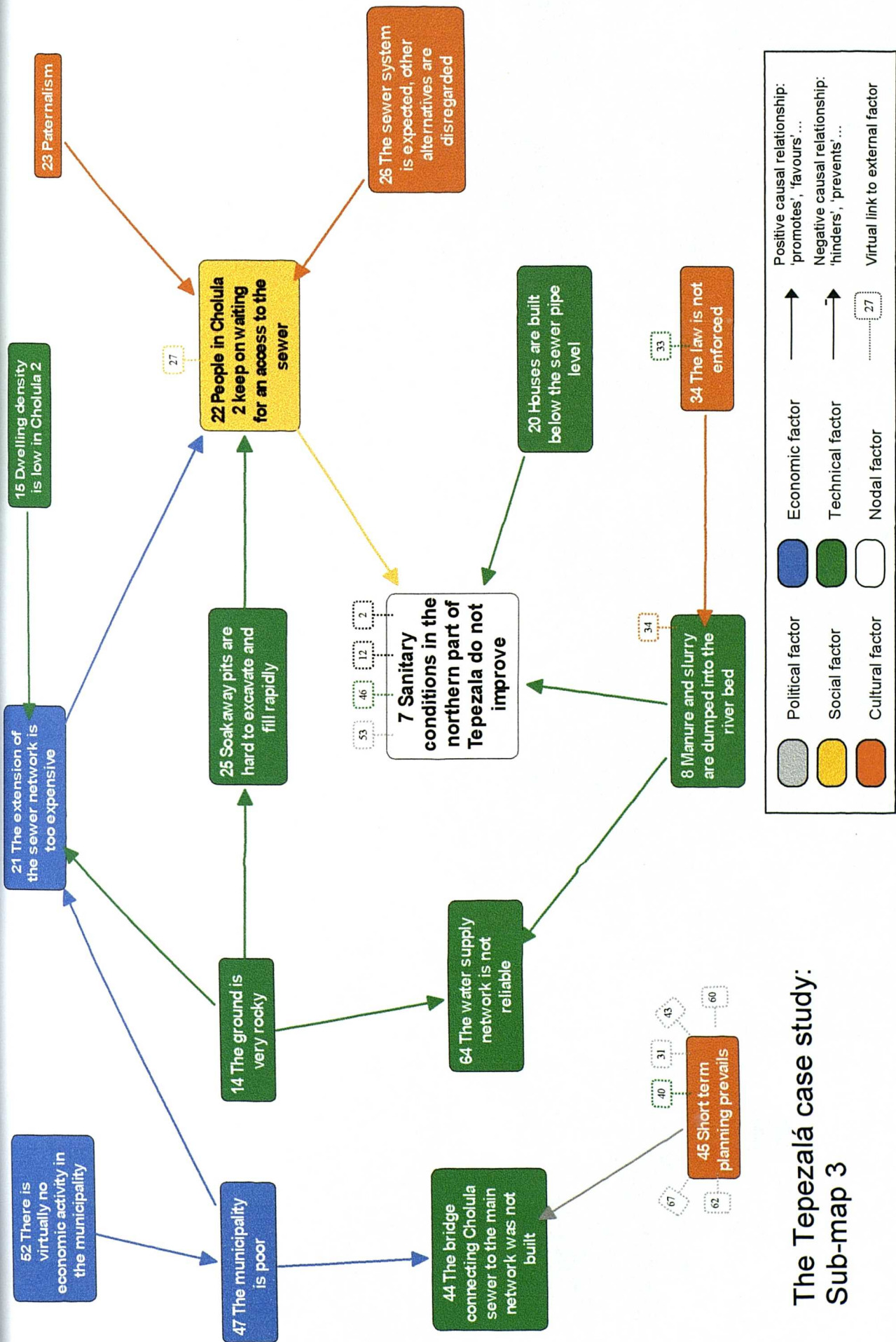
*Figure 4.30. shows the basin (almost empty) used by one farmer to store the effluent of the pond until he decides to irrigate his parcel. Depending on the detention time, this basin can improve the quality of the effluent.*

**24:** The oxidation pond is not operated in continuous flow. Instead, it is operated in batch-flow, which sequence consists in the two following steps: first, the outlet of the pond is closed and it fills up during five to six days. Then the pond is emptied and the effluent is channelled to one of the four farmers' parcel. Emptying typically takes about two to three days.

**39→24:** A continuous flow would provide the sewer effluent with a longer mean residence time, and thus a higher pathogen and nutrient removal. However, the farmers are more concerned about the quantity of wastewater available than about its quality. Only one farmer can store the effluent, which can slightly improve the quality of the effluent. They others want to keep the water losses between the pond and their parcels as low as possible. The small canals that convey the pond effluent to their respective parcels are not maintained, and water losses through evaporation and infiltration are important. As a consequence, operating the pond in batch flow suits the farmers better.

**24→1:** Oxidation ponds (also called stabilisation lagoons) are supposed to be operated in continuous flow mode. Batch flow does not allow a homogeneous detention time and disturbs the settlement of solid matter in the pond.





The Tepezalá case study:  
Sub-map 3

## 4. Sub-map 3

### 4.1. Concepts 44, 45, 47, 52



**52→47:** There is very little economic activity in Tepezalá municipality. Subsistence agriculture and a few small shops are the main local sources of employment. Tepezalá is generally regarded as one of the two poorest municipalities of Aguascalientes state. The poor local economy restricts the municipal budget.

**47→44:** The municipal budget is very limited and so does the number of civil engineering pieces of work that can be achieved by the government. These economic restrictions partly explain why the sewer network branch in Cholula (northern part of Tepezalá) was not connected to the community main network.

#### Box 4.91. Poor local economy, limited municipal budget

*'The state and federal resources are distributed among the municipalities according to their size and their economic activity. Tepezalá is small and does not produce anything.'* TI16- Municipal town-planner

*In the 80s, the state government fostered foreign investments in the region. Several important foreign companies (i.e. Nissan, Texas Instruments) established close to Aguascalientes City. The development of the industrial sector generated sources of employment and increased consumption. Many inhabitants from Tepezalá seized these new job opportunities despite the 50km distance separating the community from the factories. The Cruz Azul cement factory, established about 10km far from Tepezalá, is another source of employment for many young adults from the municipality. However, there is very little activity locally and municipal development has been very insignificant when compared to Aguascalientes City economic boom. Tepezalá was left behind and the daily life of most people has not changed much during the last 30 years.* TR6- Tepezalá Municipality

*'I am well aware of the sewer discharge issue in Cholula. I can read the necessities of all the localities of the municipality on the palm of my hand. The thing is that there is no money. Connecting Cholula's sewer to the community main sewer network is not difficult technically but it would cost around \$70000. Last year we achieved 50 pieces of work in the municipality. Now, as the president told you, the federal funds were halved and we are only gonna do 12 pieces of works next year.'* TI7- Benjamin

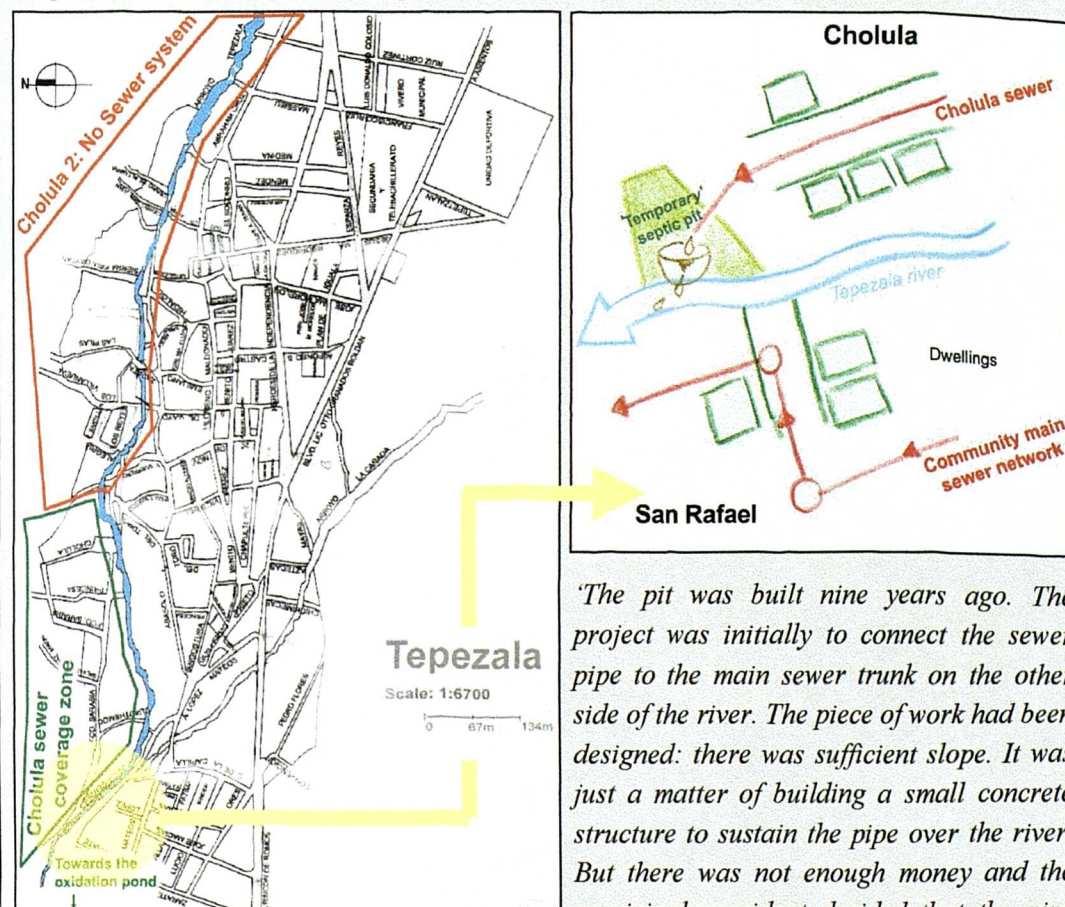


45: c.f. concept 41 section 2.1.

**45→44:** Instead of building a small bridge over Tepezalá river to connect Cholula sewer system to the main sewer network, the municipal authorities opted for a much cheaper, short-term solution. They excavated a small pit (about 6m<sup>3</sup>) in the garden of community dweller just nearby the river and allowed the sewage to discharge into it.

Box 4.92. Cholula sewage effluent discharged in 'temporary' septic pit

Figure 4.31. Cholula sewer discharge  
(adapted from Civil Eng. Dept. Tepezalá)



'The pit was built nine years ago. The project was initially to connect the sewer pipe to the main sewer trunk on the other side of the river. The piece of work had been designed: there was sufficient slope. It was just a matter of building a small concrete structure to sustain the pipe over the river. But there was not enough money and the municipal president decided that the pipe

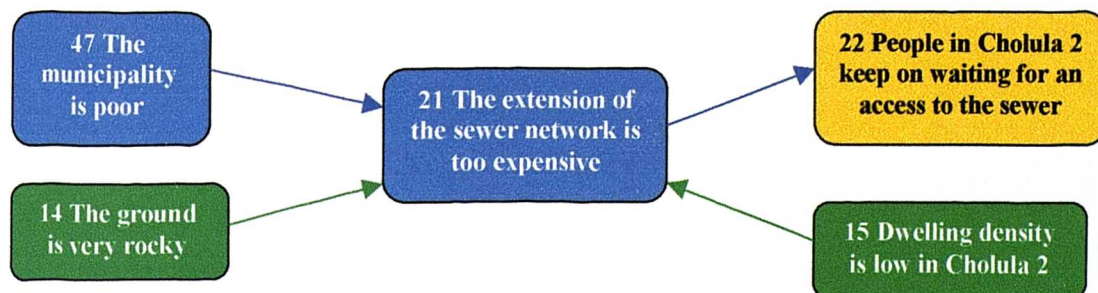
should stop here in this 'huerta' (vegetable garden- backyard). The people did not complain because the nuisance of the pit was balanced by the benefit of the sewer system. TI7-Benjamin (Municipal civil engineer)

Maria de la Paz Montes remembers that the government asked her husband and her if they would agree to have the sewer discharge in their backyard. They refused and demanded the authorities to put additional pipes in order to discharge the sewage further away. The government refused. She explains: 'There was no agreement and especially not with respect to my husband's backyard. But the civil engineer came and said: 'The orders are the orders!' and I replied: 'This is not an order, this is our backyard.' This was easier for them to



*discharge the sewage here. So they dug a pit down in our backyard, saying that this would just be temporary. They made it very small.' At the beginning there was little flow in the sewer, but after a few days, more dwellings in Cholula got connected and Maria realised that the pit was poorly designed. 'It is a mess', she said, and she mentioned that there is a risk to contaminate the Castorena well, which is located nearby the pit. She and her husband got very angry about that. They complained to the two previous municipal presidents but nothing happened. TII2 - Juan Castorena, Maria de la Paz, Fidel Garza*

#### 4.2. Concepts 14, 15, 21, 22, 47



**47:** c.f. section 4.1.

**47→21:** The extension of the community sewer system to Cholula 2 (c.f. Figure 4.31.) involves high construction costs. Due to a limited budget, the municipal government tend to favour cheaper projects, or projects with a lower cost-benefit ratio.

**14:** A large proportion of the dwellings located on the northern side of the river Tepezalá are built directly on the rock.

**14→21:** The high cost associated with digging trenches in a very rocky ground is the main impediment to the extension of the sewer system to the northern side Tepezalá river.

**15→21:** Dwelling density is lower in Cholula 2 than in the rest of the community. This increases the cost-benefit ratio of the sewer extension project.

**21→22:** The dwellers of Cholula 2 know that the high excavation cost has delayed the construction of the sewer in their area so far. Nonetheless, they keep hoping that the authorities will eventually allow the project to proceed.



**22:** Most of the 350 inhabitants of Cholula 2 keep waiting for the construction of the sewer system in their zone.

Box 4.93. Rocky ground prohibitively raises the costs of sewer extension

Figure 4.32. Houses built on the rock

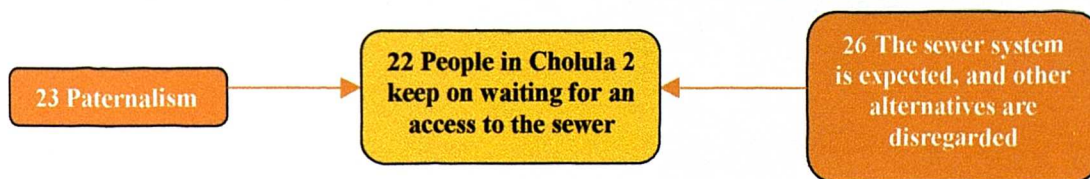


*J: 'What prevented the extension of the sewer network in Cholula 2?'*

*Jesus: 'There are mainly two motives. First, the possible lack of dedication of the previous governments and then the cost associated with the connection of the remaining dwellings. The rocky nature of the soil and the topography makes the work expensive and there are priorities in other villages that can be met more easily.'* TI17- Municipal President

*F: 'The cost associated with digging trenches in this rocky soil is the main cause. Apart from that, there are other villages, which express needs that we need to address first.'* TI2- Guttierrez (Municipal civil engineering department)

#### 4.3. Concepts 22, 23, 26



**23→22:** Paternalism is an elemental trait of the Mexican culture. Seventy years of very centralised government under the PRI (Institutional Revolutionary Party) 'democratic dictatorship' contributed to root this feature deeply in the relationships between citizens and the political authorities. The population of Cholula 2 expresses a strong feeling of dependency towards the municipal government. Most people do not intend to take any initiative to improve their sanitation facilities. They keep waiting for the government to install a sewer pipe in the street.



**22:** c.f. section 4.2.

Box 4.94. Paternalism and the hope of the sewer system

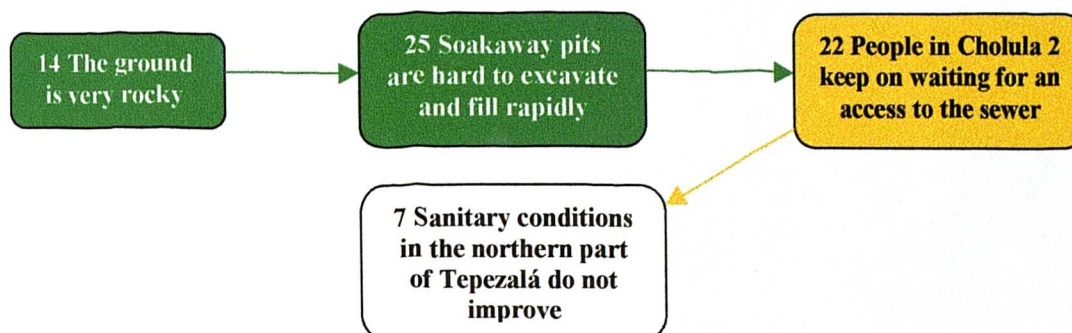
*Only 22% of the 23 persons interviewed reckoned that their sanitary conditions improved since they live in their house. The others justify this state of inertia by the fact that they have been waiting for the government to build the sewer system (52%) or to offer building material (17%). 52% of the interviewees do not plan to improve their sanitation facilities until the public authorities undertake a sanitation project. Three persons already bought a cistern-toilet seat and are ready to put it in service as soon as the sewer system is installed. Four interviewees expect support from the authorities in the form of cement bags (this was a common practise with the past governments). Although other factors hinder sanitation development in Cholula 2 (e.g. the rocky ground), it is relevant to notice that people's feelings reflect their dependence on the public authorities. TS1- Cholula Survey*

**26:** The construction of a sewer system in a community is generally perceived as the normal development step following the installation of electricity and potable water supply network. People feel upset if they do not have access to the sewer. They feel excluded from the national development trend that grants people the comfort of the cities: the 'flush and forget' sanitation. This perception exists in most of Mexico and is even stronger in the state of Aguascalientes, where 94% of the population has got access to the sewer system (INEGI 1998).

**26→22:** The people of Cholula only take into consideration the cistern-toilet-sewer system alternative. They generally discard on-site sanitation technologies that would be cheaper for the government and that could spare them waiting endlessly for the sewer.



#### 4.4. Concepts 14, 22, 25, 7



**14:** c.f. section 4.2.

**14→25:** Due to the very rocky nature of the ground in a large part of Cholula 2, septic pits are very difficult to excavate. In addition, the low porosity of the ground hinders seepage and the septic pits (or soak-away pits) tend to fill up quickly.

**25→22:** The technical impediments to the construction and efficient operation of septic pits deter people from enhancing their sanitation facilities. Most of them keep waiting for the local authorities to build the sewer system.

**22:** c.f. section 4.2.

**22→7:** As people in Cholula 2 keep waiting for the government to give them access to the sewer system, their sanitary conditions do not improve.

**7:** The sanitary conditions of the population living on the northern side of the river Tepezalá do not improve.

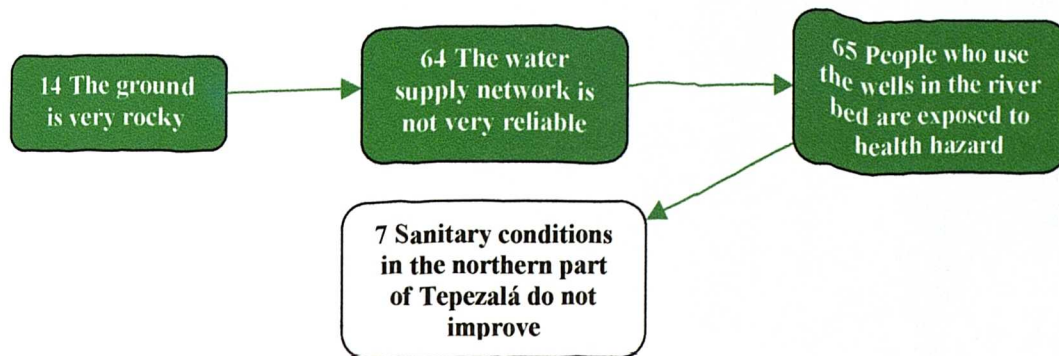
#### Box 4.95. Rocky ground hinders construction and use of septic pits.

*75% of the 23 interviewees consider that their sanitary conditions as bad, 17% as regular and 13% as good. Only five of the 23 dwellings visited had a facility to collect the excreta (two cistern-toilets/septic pit, three squatting board/septic pit). The members of the other families defecate in their backyard (43%), in the river (13%) or up the hill (21%).*

*In most cases, the hard rock prevents people from improving their sanitation facilities. They usually do not envisage any other alternative than septic pit (i.e. they could rise the toilet seat or squatting board at 1.5m above ground and dispose a receptacle to store the excreta), which they often consider too hard and time-consuming to dig. Among the 23 interviewees, five of them have excavated a septic pit and use it, 10 thought about doing it but could not because of the rocky ground. Five interviewees explained that they cannot afford it, and three people prefer to wait for the sewer system. TSI- Cholula Survey*



#### 4.5. Concepts 7, 14, 64, 65



**14:** c.f. section 4.2.

**7:** c.f. section 4.4.

**14→64:** The potable water network pipes are often laid above the ground in the northern part of Tepezalá due to the rocky ground and the high excavation costs implied. As a result of this open-air exposition of parts of the water supply network, pipes occasionally fracture.

**64→65:** When a water pipe fractures, a loss of pressure head in the network ensues, affecting the water supply of the neighbouring dwellers. Before the authorities bring a cistern truck for the population and eventually mend the broken pipe, the affected population has to rely on alternative water sources. Some people traditionally choose to fetch water from wells located in the bed of the river Tepezalá. They expose themselves to waterborne pathogens, potentially present in this water.

#### Box 4.96. Low reliability of the water supply network creates sanitary hazard

Figure 4.33. Open-air water supply pipe in Cholula 2



*10 persons reported that their water supply was already suspended during two weeks. Corrosion and exposition of the mains to the open-air are likely to be the principal causes of wearing. Plastic hosepipes supply water to a few dwellings (3-5) and fatigue more quickly. People feel that the hosepipe manifests the lack of concern of the authorities. The water supply is more or*

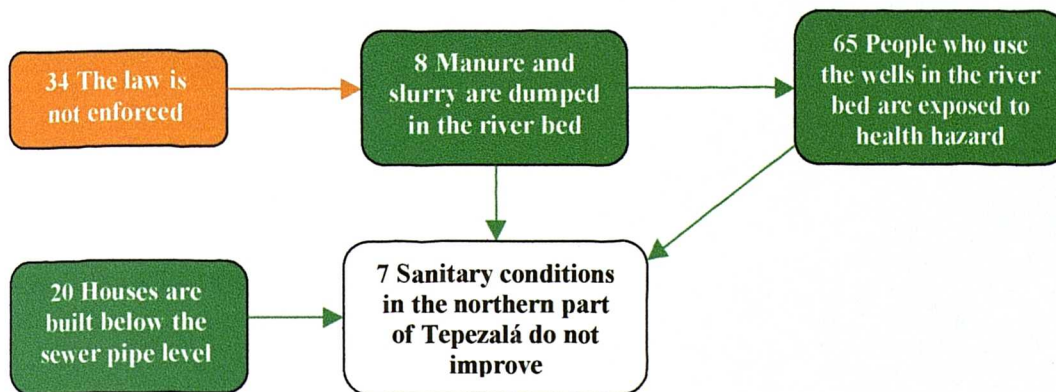
*less discontinuous according to the location of the dwelling: the further East and the higher the house, the longer the water shortages during the day. The situation has recently improved but some people still have to store water at night to meet their daily requirements. The water is usually stored in 200L container that can easily be contaminated (e.g. contact with hands*



*after open-air defecation...). During severe water shortages, a cistern allow the people to meet their very basic needs, but people living in isolated dwellings reckon that they use water from a well in the riverbed upstream. A very poor family living at the very eastern edge of Cholula<sup>2</sup> exclusively uses the water of this well, as many children do when they play in this area. Unfortunately, the members of this family did not want to be surveyed. TSI- Cholula Survey*

**65→7:** The occasional consumption of water from the well located on the riverbed threatens the health of the consumers and affects the sanitary conditions of the population of Cholula 2.

#### 4.6. Concepts 7, 8, 20, 34, 65



**20→7:** Several houses located alongside the river are built below the level of the sewer pipe. As a result, their inhabitants cannot enjoy this service and discharge their grey and black waters into the riverbed (sometimes via a shallow septic pit that seeps into the riverbed). This affects the sanitary conditions in the northern part of the community.

**34:** c.f. section 2.5.

**34→8:** Despite the law preventing the possession of farm animals at home in urban environment (Tepezalá is legally a urban community), many inhabitants keep goats and pigs at home and illegally discharge the slurry and manure into the environment, notably into the riverbed.

**8→7:** The discharge of slurry and manure into the riverbed affects sanitation in Tepezalá. Pathogens found in the faecal matter are spread in the neighbouring areas through wind action and insect vectors. Children playing in pools that remain in the riverbed during the rainy season are directly exposed to faecal-oral route contamination.



**8→65:** The discharge of slurry and manure into the riverbed can also contaminate the shallow aquifer located below the riverbed, that is occasionally used by a part of the population when the potable water supply network fails.

**65→7:** c.f. section 4.5.

Box 4.97. Contamination risks in the riverbed

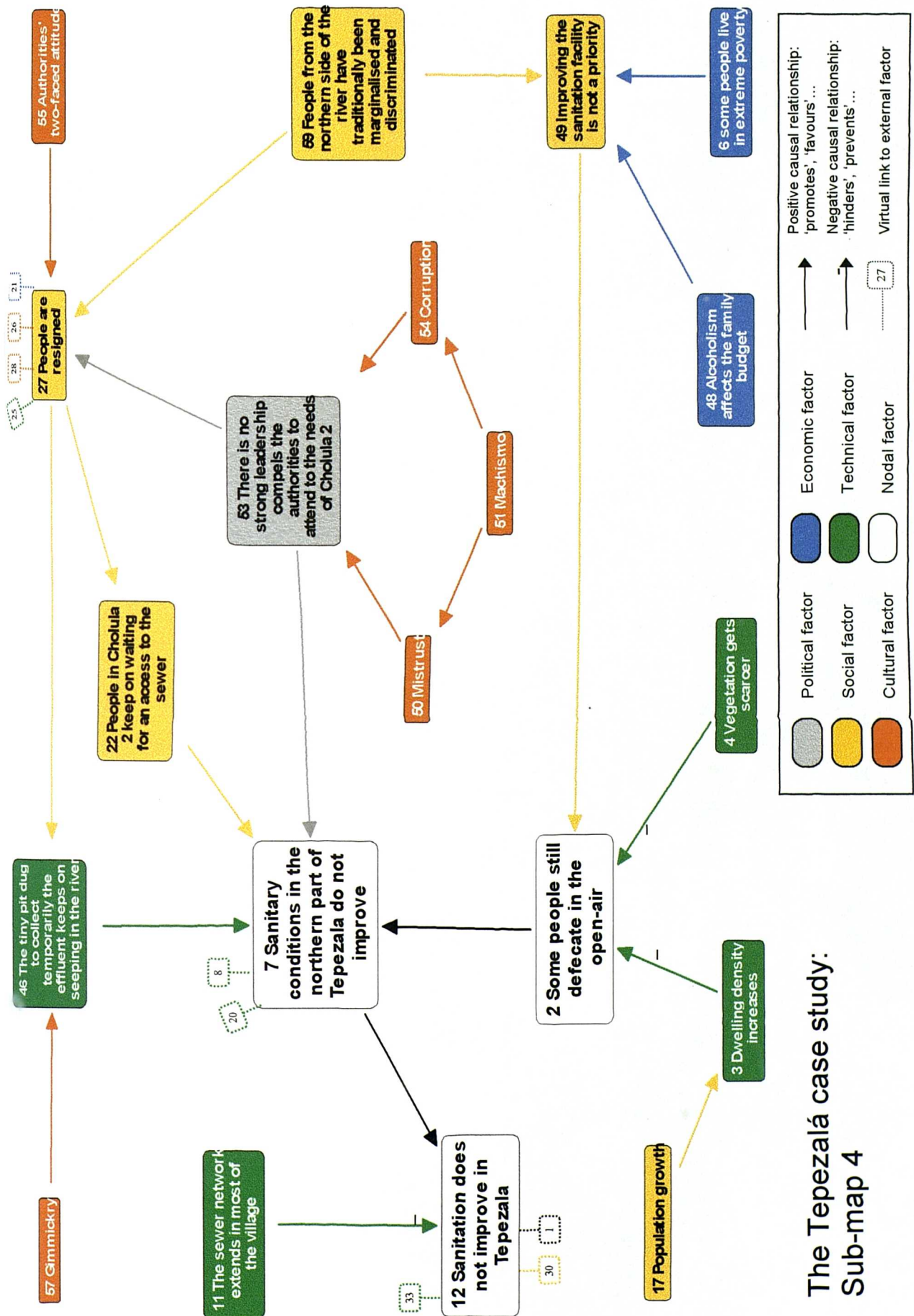
Figure 4.34. Manure discharged into the riverbed and piglet drinking in a pool



Rosa explained that her brother (who is also her neighbour) and his neighbours could not connect to the sewer because their houses are located below the level of the pipe. Thus, several months ago they excavated a pit a few metres below their houses to collect their wastewater. This rudimentary septic pit is less than 5m from the river and seepage into the riverbed is very likely due to the significant slope of the ground.

During the rainy season, large pools form in the riverbed, where children from Tepezalá and other neighbouring localities bathe. There is a pool that people call 'el cagadero' (the 'shitting place') because women wash babies underclothes there. Juan explained me that when there is no tap water for more than a week, all the people from Cholula and from the edge of San Rafael go to the well 'Castorena' and drink from this water. There is a risk that the well gets contaminated by wastewater seeping from Cholula septic pit to the riverbed.

TII2 - Juan Castorena, (Municipal syndicate)

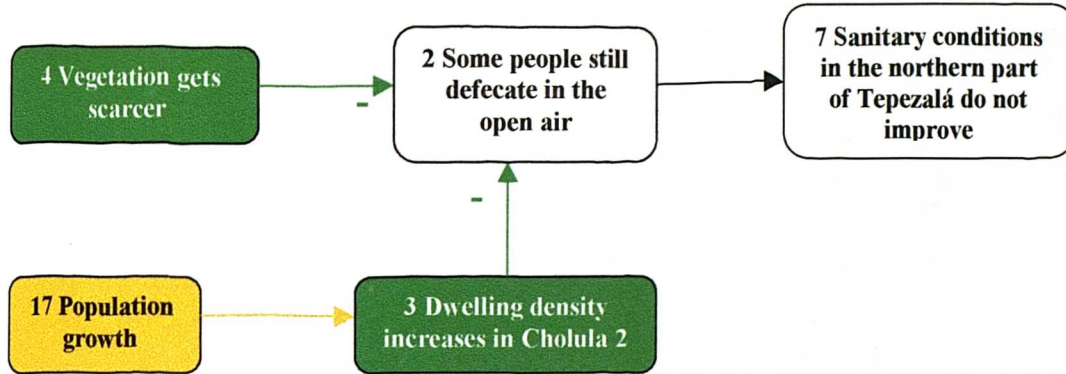


## The Tepezalá case study: Sub-map 4



## 5. Sub-map 4

5.1. Concepts 2, 3, 4, 7, 17



17: c.f. concept 56 section 2.6.

17→3: Though population density in Cholula 2 remains lower than in the rest of Tepezalá, population growth has led to the construction of more houses in the area.

2: Defecation in the open air is still practised by a large fraction of the population of Cholula 2.

3→2: Increasing dwelling density in Cholula 2 reduces the availability of quiet and private open-air defecation sites.

4→2: Vegetation has become scarcer, and there are less quiet and sheltered areas ideal for open-air defecation.

2→7: Open-air defecation in the way it occurs in Cholula 2 does not promote better sanitary conditions for the population living in the northern side of the river. Faeces are exposed to the wind and to insect vectors that can spread potential pathogens.

7: c.f. section 4.4.



## Box 4.98. Dwelling density and open-air defecation in Cholula 2

Figure 4.35. Defecating sites



(left hand-side: on Tepezalá river banks, right hand-side: on the eastern edge of Cholula 2)

*On average, the 23 people interviewed have been living for eight years in their house. 41% of them settled here less than 2 years ago. Young people succeed their folks in existing dwelling, and new houses are being built at the edges of Cholula 2. Hence the distance to cover to reach proper defecating sites. 78% of the people surveyed defecate in the open-air: in their backyard (43%), in the riverbed (13%) or up the hill (21%).*

*None of the persons interviewed considers that open-air defecation provides good sanitary conditions, although 24% find it all right, especially when one defecates in one's backyard. People do not mention covering the excreta with soil (which does not appear to occur, generally) and a significant part of the interviewees do not use toilet paper or use it only occasionally.*

*People stress the fact that proper defecating sites are getting harder and harder to find. Many people recall that open-air defecation was not such a problem in the past because one had sufficient privacy and could do it close to home. Now, new houses are being built on the edges of Cholula 2 and the vegetation is disappearing. Episodes of diarrhoea are thus particularly annoying. Defecating at night is thus often the best. TS1- Cholula Survey*



## 5.2. Concepts 2, 6, 48, 49, 59



**59:** On the northern side of the river people have traditionally lived in poorer conditions than the rest of the community, and they have always been socially marginalised from the rest Tepezalá.

**59→49:** Many people in Cholula and Cholula 2 live in a very marginal way and are socially isolated from the rest of the community. For a majority of them, building or improving a sanitation facility is not a priority, as they are not so much concerned about what people may think of their precarious way of life.

## Box 4.99. Marginality in Cholula 2

*'The way teenagers express themselves reveals some differences: cultural differences, differences in the habits, in the way of life. Many things suggest that these people [who live on the northern side of the river] live differently. This can be due to the fact that the land is cheaper over there. On the northern side of the river, people are more isolated. The material of construction is not the same. The houses are not as well finished as in the centre of Tepezalá. There are less commodities available in Cholula 2. People settle where they can afford. You instantly feel that the atmosphere is not the same over there. There are contrasts within the same population and you can find that anywhere. Nonetheless, in some places it is more striking. The presence of the river as a frontier emphasises it.'* TI9- José Baez Rodríguez (high school director)

*Cholula appears to be much older than the rest of the village. Several caves remain, which were formerly the settlements of the indigenous people. On the other side of the river, one can find ruins of houses made of stones, where the mine products (copper, zinc, silver) were processed. In former times, the rich people lived on the southern side of the river, while the poor, the workforce, lived on the other side, which now corresponds to Cholula and Cholula 2. This is the oldest part of the village and the settlements are legal. Nothing can legally prevent this population to get access to the same public services as in the rest of the village. One can reasonably assume that the marginalisation we can observe nowadays is rooted in the past.* TI16- Municipal town-planner



**48→49:** Alcoholism chronically affects a large part of the men in Tepezalá. As much as 30 to 40 percent of the family weekly income is spent on alcohol. In this context, saving money for improving the domestic commodities, sanitary facility included is very complicated. The money available is primarily used for buying foodstuffs, paying electricity bills, transport and buying clothes.

**6→49:** On the northern side of Tepezalá river, some people live in conditions of extreme poverty. Their main preoccupation is to find some food for the day or for the coming week, and building a pit latrine to improve their sanitary condition is not a real concern for them.

**49→2:** For many people of Cholula 2, improving the sanitary conditions is not a priority and consequently open-air defecation continues.

#### Box 4.100. Extreme poverty

Figure 4.36. Family in high poverty and marginalisation in Cholula



Figure 4.37 shows an old woman with her two grandchildren with dusty faces and stained clothes. Their parents do not live here at the moment. A chalky rock cave forms the basement of their precarious adobe house. According to Juan Castorena, this family is not only poor: the man is not at home, and the grandmother stays at home. She never appears in public because 'she is dirty, these people are abandoned'. T112- Juan Castorena

'Actually, there are some very poor people in the municipality. Some defecate in the open air although they know it is not hygienic. They often can't afford to connect their dwelling to the sewer pipe, which is just 15m away from their home.' T117- Jesus Delgado (Municipal president)



### 5.3. Concepts 7, 22, 27, 55, 59



**59:** c.f. section 5.2.

**59→27:** The state of marginalisation of people in Cholula 2 is manifest through their resignation, while the local authorities express much indifference to their precarious conditions of life.

**27:** Most people in Cholula 2 are resigned to the unconcern of the municipality about their needs. They do not express any motivation and willingness to struggle to obtain municipal support for improving their sanitary conditions.

**55:** Mexican people excel in the art of dissimulation, that is, in the ability to play different roles in different contexts. This two-faced attitude, which is notorious and manifest in politics, forms part of the Mexican culture.

**55→27:** People in Cholula 2 feel that they have repeatedly been lured by several candidates to the municipality presidency, who promised them the construction of a sewer system and other public services. Most of these commitments were never met, and consequently many people have lost faith in the government. These repeated lies and paternalism made the population apathetic and resigned.

**27→22:** Generally speaking, the population of Cholula 2 is resigned and does not try to put pressure on the government to obtain support for better sanitary conditions. As a result, they endlessly keep waiting for the local authorities to build the sewer system.

**22:** c.f. section 4.2.

**22→7:** As a result of passively waiting for the construction of a sewer system, people's sanitary conditions in the northern part of Tepezalá do not improve.

7: c.f. section 4.4.

Box 4.101. Two-faced attitude anaesthetises the capacity of reaction of the population

*'The succession of contradictory government announcements and Mexicans' historic scepticism about their leaders had helped to cement a feeling of political numbness in the population. [...] There was nothing new about Mexico's tradition of lying, of course. Since as far as historians could remember, double-talk and deceit had been a part of Mexico's national character. Historians said deceit was the way in which Spanish viceroys defended themselves against kings who demanded ever-growing levies from the New-World, and the Indians' way of protecting themselves against the exploitation of their Spanish rulers. Mexicans in the colonial days would say yes to everything while doing as little as possible. Centuries later, Mexicans would sum up this national tradition with the saying 'Obedezco, pero no cumplo' ('I obey, but I don't comply').' (Oppenheimer 1996)*

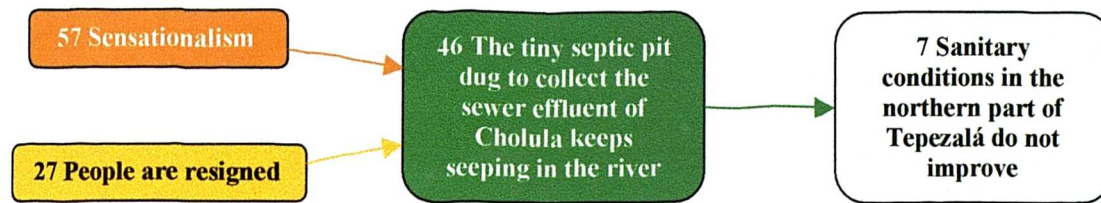
*The current mayor is very aware of people's precarious sanitary conditions in Cholula 2. Several interviewees reported that when they campaigned for his election, he promised them that their request would be his first priority because the emergency of the situation required a quick solution. After his election, he then tempered his statement. According to 10 interviewees, he claimed that the sewer system would be built within the three years of his term of office. Finally, he recently admitted after a year on power, that a hypothetical construction phase would not start before one year. The people that supported him are obviously extremely disappointed and many do not trust at all the public authorities any more. Some reckon that they would rather hear the mayor say: 'No, we won't do it' than 'Yes, we'll do it as soon as we can'. An interviewee reckoned that she is ashamed to see the authorities deal with them as 'naive children, rag dolls'.*

*Some people also report that most of the civil engineering works are achieved in the small surrounding localities but that Cholula 2 is neglected. People express their indignation as they realise that sidewalks were built in peripheral parts of Tepezalá, whereas they ask for a very basic and indispensable sanitation service. TS1- Cholula Survey*

*Several community members described the population of Cholula and Cholula 2 as a marginal, and lazy one, with poor habits of hygiene and little self-esteem. These people are discriminated by the others, and they themselves feel left apart from the rest of the community. According to the town planner, the people from the northern part of Tepezalá are less able to express themselves in public, which prevent them from voicing their needs and complaints to the authorities. TI16- Municipal town-planner*



#### 5.4. Concepts 7, 27, 46, 57



27: c.f. section 5.3.

27→46: The population of Cholula is somewhat apathetic and does not try to put pressure on the government to find a sustainable solution to the precarious discharge of their sewer network (c.f. Box 4.92. section 4.1.). The government feels no urgency to deal with this issue.

46: The small septic pit, that the government built nine years ago as a temporary measure to collect Cholula sewer effluent, keeps seeping in the river.

57: To stand out from the others, to put a shine on their self-image or on that of the community, political leaders often favour projects that are aesthetic and culturally consensual at the expense of more indispensable, down-to-earth projects, which substantial benefits for the population are less apparent.

57→46: Only a dozen of riparian families are affected by the discharge of Cholula sewage in the small pit dug in a backyard by the river. The population is not very aware of the detrimental effects of this sewer discharge (environmental damage and contamination risks). The government prefers to undertake visible projects that will be perceived as real benefits by a majority of people, rather than spending a lot of money solving this misappreciated sewer discharge issue.

#### Box 4.102. Sensationalism and priorities

*'It is common that governments waste money on inessential but visible pieces of work, instead of giving necessary maintenance to a useful infrastructure, which the people would not notice.'* T117- Municipal President

*Politicians usually want to distinguish themselves from their predecessors: they want to leave their print. This has two major consequences. On one hand, the implementation of long-term projects involving the contribution of several governments to the same task becomes difficult. This is particularly true when the governments are from opposite parties. In that case, the new party on power restart from scratch and rarely pursue the objectives of the previous*

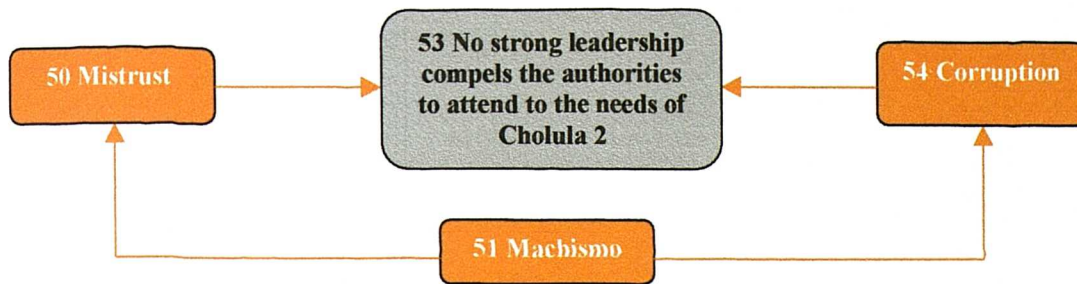


government. On the other hand, the public authorities tend to focus on actions, which benefits to the population are more tangible. For example, instead of mending a fractured sewer pipe, or spending money to maintain a remote pond, the municipal government of Tepezalá decided to build sidewalks, public benches, and refurbished religious monuments. TR2 - WWT improvement implications

**46→7:** Failure to solve the issue of the sewer effluent in Cholula keeps sanitation of the neighbourhood in a precarious state, with detrimental impacts on the environment, nuisances for the riparian population, and contamination risks for the people living in this area.

**7:** c.f. section 4.4.

5.5. Concepts 50, 51, 53, 54



**51:** Machismo is a fundamental cultural feature of the Mexican people, which determines the gender roles and affects the behaviours of men in society. The macho has to prove his strength and invulnerability and becomes a hermetic person outside his home.

**51→54:** The macho tends to see the world as a battleground where only the fittest survives: ‘One has to defeat the other or the other will defeat you’, or more commonly said in Mexican slang: ‘Chingas o te chingan’ (‘You fuck or you get fucked’). This perception of human relationships encourages corruption.

## Box 4.103. Machismo

*'The speech of our people reflects the extent to which we protect ourselves from the outside world: the ideal of manliness is never to 'crack', never to back down. Those who 'open themselves up' are cowards. Unlike other people, we believe that opening oneself up is a weakness or a betrayal. The Mexican can bend, can bow humbly, can even stoop, but cannot back down, that is, he cannot allow the outside world to penetrate his privacy. The man who backs down is not to be trusted, is a traitor or a person of doubtful loyalty; he babbles secrets and is incapable of confronting a dangerous situation. Women are inferior beings because, in submitting, they open themselves up. Their inferiority is constitutional and resides in their sex, their submissiveness, which is a wound that never heals. Hermeticism is one of the several recourses of our suspicion and distrust. It shows that we instinctively regard the world around us to be dangerous. This reaction is justifiable if one considers what our history has been and the kind of society we have created. The harshness and hostility of our environment, and the hidden, indefinable threat that is always afloat in the air, oblige us to close ourselves in, like those plants that survive by storing up liquid within their spiny exteriors. But this attitude, legitimate enough in its origins, has become a mechanism that functions automatically.*

*Our response to sympathy and tenderness is reserve, since we cannot tell whether those feelings are genuine or simulated. In addition, our masculine integrity is as much endangered by kindness as it is by hostility. Any opening in our defences is a lessening of our manliness. Our relationships with other men are always tinged with suspicion. Every time a Mexican confides in a friend or acquaintance, every time he opens himself up, it is an abdication. [...] If we hide within ourselves in our daily lives, we discharge ourselves in the whirlwind of the fiesta. It is more than an opening out: we rend ourselves open. Everything-music, love, friendship-ends in tumult and violence. The frenzy of our festivals shows the extent to which our solitude closes us off from communication with the world. We are familiar with delirium, with songs and shouts, with the monologue... but not with the dialogue.'* (Paz 1985)

*'In Mexico, the world was perceived as a place divided between rapists and raped, where the first were perceived as winners and the latter as losers. In this context, the maximum values were machismo and the capacity to impose one's will over other, and political chieftains, feudal landlords and unscrupulous business tycoons were perceived as winners in one part of Mexico's collective mind, Paz noted.'* (Oppenheimer 1996)

**54:** Corruption is an elemental feature of the Mexican culture. It pervades most of the institutions and all levels of society.

**54→53:** Corruption of informal community leaders by public authorities prevents the emergence of groups of dwellers of Cholula 2 that are capable to compel the authorities to attend to their needs.

Box 4.104. Corruption as a natural by-product of machismo

*'Much of the Professor's [Carlos Hank Gonzalez] fortune dated from his days as Mexico's state governor and Mexico City mayor, when he allegedly purchased millions of dollars' worth of garbage trucks, tractors, and buses from a company run by his sons. When he was asked at about that time how he had risen from a penniless rural teacher to a multimillionaire, he had smiles and quipped, 'Un politico pobre es un pobre politico'-'A politician who is poor is a poor politician'. ' (Oppenheimer 1996)*

*José Reyes Ramirez mentioned the sad fate of many politically active groups. When he was back from the USA, a few years ago, he joined a group that was meeting regularly to discuss and criticise the politics of the municipal government. The authorities soon regarded them as a nuisance and dissolved the group by corrupting the leaders (by offering them financial or material goods).*

*José also recalls that his father was ejidal commissioner and that some politicians from the state government came one night to ask him a signature in exchange of some advantages (i.e. build a house...). These examples show why some persons can be reluctant to forming group. In a previous survey with farmers, it was similarly observed that co-operation is refused as people fear to be cheated. TS1- Cholula Survey*

*José Villalobos is apparently the only active leader of Cholula 2. He brought a petition to the authorities to get the electricity and the sewer system installed in that part of Tepezalá. A few people ignore his leadership. At the exception of a direct neighbour, they all live at the edges of Cholula 2. Several women argued that José does not represent fairly the interest of the whole group. His street got the electricity posts installed first and many people have not got electricity yet. Improving sanitation does not seem to be so important for him, since he already has got a flush toilet and a septic pit at home. Some interviewees stressed that José Villalobos benefits more from the public authorities than the others. A woman recalled that the municipal president once offered plastic containers to the people of Cholula 2. José and his relatives received large and practical ones, whereas the interviewee just got two 1L 'baby-toy' buckets. She really got ashamed and angry about it. That is why she does not recognise José Villalobos as a good leader. TS1- Cholula Survey*

**51→50:** The macho is a hermetic person who only trusts his family and his very best friends. He deals with other people with mistrust and precaution to make sure he will not be deceived by them. As a consequence, by favouring mistrust, machismo does not encourage the development of tight bonds among the families that live in Cholula 2.

**50:** There is a feeling of mistrust amongst the dwellers of the northern part of the village.

**50→53:** Mistrust among the people in the northern part of Tepezalá prevents the creation of a powerful group organised around one or several leaders that would be able



to pressure the municipal authorities and obtain support from them to improve sanitation in the neighbourhood.

**53:** There is no leadership capable to compel the municipal authorities to improve the sanitary conditions of the people living in the northern part of the village.

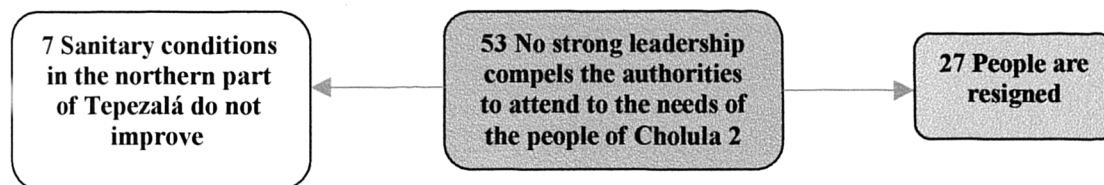
#### Box 4.105. Mistrust

*'Mexicans had such an inborn scepticism, that they regarded the very concept of 'truth' with great suspicion, as the Coca-Cola Company, and other U.S. corporations found in their various marketing studies in Mexico. The Coca-Cola company, for instance, had discovered with puzzlement that advertising campaigns emphasising the concepts of reliability and trustworthiness did not work in Mexico. [...] 'We found the word truth had a negative connotation in Mexico', I was told by Jorge Matte Langlois, the Chilean-born psychologist, sociologist, and theologian who had conducted confidential poles for the Zedillo campaign, and who had conducted the focus groups for Coca-Cola years earlier. 'People's reaction was, if it's the truth, it must be bad'' (Oppenheimer 1996).*

*Mistrust often prevails amongst community members. The fear that the personal interests of some will jeopardise the whole enterprise is deeply rooted in the mind, result of fruitless co-operation experiences of the past. As the farmers express it: 'Everyone matters is own business, and this is how it works best'. TR4- Stakeholder Analysis.*

*35% of the 23 interviewees do not discuss the problem of sanitation with their neighbours. Low dwelling density and existing conflicts among neighbours are partly responsible for this lack of communication. One interviewee expressed her shame to discuss this topic with others, while two women explained that 'Everyone scratches himself with his own nails', a local saying that clearly states that the problem each one experiences need to be solved individually. Two interviewees mentioned that they do not talk about sanitation with their neighbours because they already have toilets. TSI- Cholula Survey*

#### 5.6. Concepts 7, 27, 53

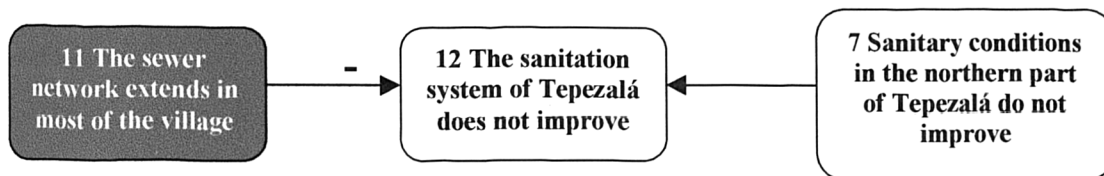


**53:** c.f. section 5.5.    **7:** c.f. section 4.4.    **27:** c.f. section 5.3.

**53→7:** Lack of strong leadership to voice the needs of the population of Cholula and Cholula 2 hinders the improvement of sanitation in this part of the community traditionally neglected by the authorities.

**53→27:** The inability of the people living on the northern side of the river to trust each other, to form a group and find a leader to compel the authorities to attend to their needs leads to a state of resignation and apathy.

#### 5.7. Concepts 7, 11, 12



**7:** c.f. section 4.4.

**7→12:** Failure to improve the sanitary conditions in the northern part of Tepezalá affects the state of sanitation of the whole community. The presence of several sources of faecal contamination in the public domain (i.e. open-air defecation, sewer discharge in the river) hinders the sustainable development of sanitation in Tepezalá.

**11:** The sewer system is being extended in the central part of the community. More people are thus getting the possibility to direct safely the faecal matter and the associated pathogens away from their home.

**11→12:** Though excreta removal is only a link of the sanitation chain, its safe completion improves health conditions in the population.

**12:** Despite the extension of the sewer system in certain zones of the community, sanitation in Tepezalá does not significantly improve. Excreta collection and disposal remains very precarious in Cholula 2. Discharge of Cholula sewer effluent into the river (via a tiny, seeping septic pit) remains unsolved. There is virtually no wastewater treatment occurring in the so-called 'oxidation' pond, which makes hazardous all the wastewater reuse activities.

## **6. Conclusion**

Lack of political continuity was identified as an important impediment to sanitation development. On the one hand, high political turnover prevents the municipal government to build up a good knowledge of the sanitation requirements in the different parts of the community. On the other hand, lack of political continuity at municipal and state level results in the incapacity of the authorities to launch long-term water and wastewater management strategies. As a consequence, wastewater treatment and reuse is not encouraged and sanitation develops bit by bit without a global vision. For instance, in Tepezalá, the pond was built as a storage reservoir rather than as a wastewater treatment system, and no provision was made for its maintenance and operation. This accounts for its poor condition (sludge accumulation and vegetation growth on the banks) and partly explains why the leakage of the sewer before the pond has not been mended. The small septic pit, which collects Cholula sewer effluent, was a temporary alternative to connecting both sewer networks by building a bridge over the river. This is another example of piecemeal sanitation development, which proves to be inappropriate in the long-term.

Considering the regional context of water scarcity, the farmers reusing the pond effluent are not very concerned about its quality. They operate the pond in batch-flow mode because most of them do not have a basin to store the effluent. As a result, the quality of their irrigation water is very poor. The mismanagement of the pond does not inconvenience much the population, because it is still far enough from the village. Furthermore, protecting the environment is not a top priority for most of the community members and they do not buy the products irrigated with the pond effluent anyway.

Tepezalá is one of the poorest municipalities of the state and the government budget is limited. This is one reason why Cholula sewer has not been extended to Cholula 2 nor connected to the main network.

Rocky ground in Cholula 2 makes the construction of pit latrines difficult. High poverty and alcoholism makes it difficult for families to improve their sanitation facilities. Open-air defecation becomes less convenient as dwelling density increases.



People living in the northern part of the village have always been marginalised and they are resigned to the lack of concern of the government about their poor sanitary conditions. Mistrust and corruption hinders the emergence of a leadership, which could compel the authorities to help the people improve their sanitation facilities in Cholula 2 and connect Cholula sewer to the main sewer network. Paternalism and the authorities' two-faced attitude nourish people's resignation.

Despite the extension of the sewer system in the southern part of the community, globally the sanitary conditions of people do not significantly improve. Poor level of law enforcement result in hazardous farming practices. Slurry and manure dumping into the riverbed continues.

## Chapter 5 - Common Patterns

### **1. Introduction**

As explained in Chapter 3 section 2.1, the case studies selection process sought diversity. Despite the great diversity of the results presented in Chapter 4, the descriptions of the sanitation systems of Tepezalá, San Luis Beltran and El Mirador nonetheless reveal many similarities. The purpose of this chapter is to examine the correspondences across the case studies and establish to which degree generalisations can be drawn from these similarities. This analytical process does not focus on the complexity and the interconnectedness of the factors influencing sanitation development, which is the aim of the conceptual maps. By allowing some parts of the results to be generalised, this chapter can bring out key elements for the understanding of sanitation development in Mexican villages.

For practical reasons, the common features found in the case studies are arranged in four themes: cultural patterns; political patterns; urbanisation patterns; and economical patterns. These four categories form the structure of this chapter. Each theme is divided into two sections. The first section is a concise review of the similarities among case studies. It is followed by a thematic discussion, bringing the identified topics altogether and examining the relevance of any generalisation in the light of the existing literature.

### **2. Cultural patterns**

#### **2.1. Recurring cultural features**

##### **a) Corruption**

Bribery and corruption were identified as significant influences on the development of sanitation in each and every case study. Whether occurring in the higher spheres of government or at local level, frauds were found to affect the sustainable development of sanitary conditions.

- In El Mirador, two school parents' committees were involved in such deeds. Additionally, the community groundwater supply project was jeopardised by the fraud of one member of the community council with the borehole drilling company.

Generally speaking, the recurrent corruption in El Mirador led to divisions in the community. In the Morelos primary school, the irresponsible behaviours of staff members was tolerated by the powerful and corrupt teachers' union of Oaxaca.

- In San Luis Beltran, the reputation of the state sanitation program supporting the construction of ecological toilets in rural areas was stained by massive government frauds. The bribery that granted exclusivity of the ecological toilet seats contract to a single firm of Mexico City ruined the community workshop.
- No such direct influence of corruption on the sanitation situation was established in Tepezalá, but informal the investigation revealed that formal and informal community leaders are sometimes bought off by municipal or state authorities and this hampers the rise of proactive community groups.

b) Two-faced attitude

The duplicitous, two-faced attitude of officials from local, municipal and state governments was identified on several occasions as a major hurdle to the development of sanitation projects.

- In El Mirador, the municipal authorities simultaneously maintain two contradictory stances. On the one hand, they let the community leader plan an extension of the sewer network to all the dwellings. On the other hand, they declare to other community members that, given the lack of wastewater treatment plant and the severe river and groundwater contamination, no more sewers should be built in the zone, hence ecological toilets should be preferred.
- In Tepezalá, before his election in 1998, the municipal president had promised his supporters in Cholula 2 that in the event of victory at the elections his priority would be to build them a sewer system. After two years in power, he finally confessed that the sewer system was maybe not going to go ahead during his term of office.
- In San Luis Beltran, the state governor Dióodoro Carrasco gave his word to Geronimo Perez, that he would provide some work to the community ecological toilet workshop. Government officials who were trained in the workshop reiterated these promises, but none of them were kept. The toilet seats contract was wholly awarded to a firm from Mexico City. When the community leader Francisco



Pacheco presented the sewer project at a community assembly, he affirmed that the work would be entirely free of charge for the population. This enticing incentive turned out to be a mirage, since all the community dwellers were required to contribute financially to the project.

c) Mistrust

A general atmosphere of mistrust permeated the three communities investigated. On several occasions this had an indirect but significant impact on sanitation development.

- In Tepezalá, part of the population of Cholula 2 distrusted the efficiency of their informal leader and considered him a self-interested person. Most people in Cholula and Cholula 2 do not have much faith in the municipal authorities. The farmers reusing the pond effluent did not want to take the risk of working together and being deceived.
- In San Luis Beltran, the community leaders have always been a little mistrustful of the municipal authorities, fearing for the political autonomy of the village. About half of the population was not inclined to contribute to the sewer project, mainly because they were doubtful about the completion and proper operation of the sewer system. Regarding the construction of the ecological toilets, most people decided to locate the facility in the far corner of their backyard because they did not have faith in that technology.
- In El Mirador, the recurring frauds at community and school level kept the community and the pupils' parents distrustful of the projects and deeds undertaken by the community council and the school parents' committee.

d) Resignation

The passivity and resignation of people witnessing unscrupulous and dishonest deeds, or enduring harsh conditions of life is another feature that was identified during the investigation.

- In the Morelos primary school, El Mirador, most of the parents that could not afford to send their children to another school were resigned to the irresponsible disposition of some staff and to the recurring frauds of the school parents committee. Since the five cistern toilets built in 1998 are useless the parents do not

want to hear about or embark on another costly sanitation project and resign themselves to the poor school sanitary conditions.

- The artisans of the community workshop producing ecological toilet seats in San Luis Beltran are resigned to the fact that the state governor is not going to fulfil his commitment to support their small business.
- In Tepezalá, the population of Cholula 2 espouses a passive attitude towards the municipal president who promised them the long-awaited sewer network extension. The same thing occurs in Cholula where riparian dwellers have been expecting the resolution of the 'temporary' sewer discharge issue since the early 90s.

e) Machismo

Though machismo was not studied in great detail, it pervades the whole Mexican culture and some of its manifestations appeared to influence sanitation development in the three villages studied.

- In El Mirador, in Tepezalá, and to a lesser extent maybe in San Luis Beltran, the men, who usually are the only source of family income, also often decide how to spend the money. Women are generally more insightful and likely to define the needs at home, notably sanitary improvements, since they spend most of their time in the house with the children. Men are often less aware of these realities and tend to minimise the need to enhance the sanitation facilities, while the women struggle to prevent their husbands drinking their salary at the weekend.
- In Morelos primary school, El Mirador, the female teachers are indignant at the irresponsible attitude of three male staff members, who jeopardise their efforts to promote hygiene and an appropriate environment for studying. However, as Mexican women, they are not supposed to be assertive and dictate to men, and as a result, they remain passive.

## 2.2. The 'Chingada' syndrome

Corruption, a two-faced attitude, mistrust and resignation are cultural features that have been identified as significant influences to sanitation development in the three case studies. Is that enough to affirm that they are representative of Mexico? What do they have in common? How do they relate?

a) Cortés and La Malinche

The Nobel prize-winning poet-essayist Octavio Paz presented in his 1950 classic, *The Labyrinth of Solitude*, what is still considered as Mexico's premier psychological profile. According to Paz, the cultural features described in the above section characterise Mexico and stem principally from the period of the Conquest:

'If the *Chingada* is a representation of the violated Mother, it is appropriate to associate her with the Conquest, which was also a violation, not only in a historical sense, but also in the very flesh of Indian women. The symbol of this violation is donna Malinche, the mistress of Cortés. [...] Donna Marina becomes a figure representing the Indian women who were fascinated, violated or seduced by the Spaniards. [...] the Mexican people have not forgiven La Malinche for her betrayal. She embodies the opened, the *chingado*, to our closed, stoic, impassive Indians. [...] The strange permanence of Cortés and La Malinche in the Mexicans' imagination and sensibilities reveals that they are something more than historical figures: they are symbols of a secret conflict that we have still not resolved. [...] *Chingar*, then, is to do violence to another. The verb is masculine, active, cruel: it stings, ruins, gashes, stains. The *chingon*, is the *macho*, the male; he rips open the *chingada*, the female, who is pure passivity, defenseless against the exterior world' (Paz 1985).

According to Paz, the symbols of Cortés and La Malinche still permeate the Mexican culture, and are manifest through the predominance of the closed over the open. The macho and the martyred woman are stereotypes as well as role ideals in Mexican culture (Schneider and Silverman 1997). As stereotypes, people can play them, criticise and reject them, but they frame people's interactions.

b) Hermeticism

'The Mexican *macho*-the male- is a hermetic being, closed up in himself, capable of guarding both himself and whatever has been confided to him. Manliness is judged according to one's invulnerability to enemy arms or the impacts of the outside world. [...] Hermeticism is one of the several recourses of our suspicion and distrust. It shows that we instinctively regard the world around us to be dangerous. This reaction is justifiable if one considers what our history has been and the kind of society we have



created. [...] But this attitude, legitimate enough in its origins, has become a mechanism that functions automatically' (Paz 1985).

Correspondingly, Schneider and Silverman (1997) notice that in Mexico, '[...] the outer world is perceived as a dangerous, treacherous, corrupt place. Business, government, the police, unions, schools, towns, and neighbours are not to be trusted. Social relations in the public world require watchfulness.'

In the 'open-closed' duality symbolised by the figures of La Malinche and Cortés, mistrust is a precaution, a defence measure protecting the masculine integrity. As Paz remarks: 'Any opening in our defenses is a lessening of our manliness. Our relationships with other men are always tinged with suspicion. Every time a Mexican confides in a friend or acquaintance, every time he opens himself up, it is an abdication' (Paz 1985).

Andres Oppenheimer shows in his book, *Bordering chaos*, that this distrustful attitude was still very prevalent during the early 1990s: 'Mexicans had such an inborn skepticism, that they regarded the very concept of 'truth' with great suspicion, as the Coca-Cola Company, and other U.S. corporations found in their various marketing studies in Mexico. The Coca-Cola company, for instance, had discovered with puzzlement that advertising campaigns emphasising the concepts of reliability and trustworthiness did not work in Mexico' (Oppenheimer 1996).

Resignation can be regarded as a form of stoicism. It is another manifestation of the hermeticism. Resignation is exalted as a virtue in Mexico, whereas it is rather considered as a weakness in western modern societies. Complaining of the inadequacy of sanitation to the municipal authorities, as in the Tepezalá case study, would mean just the opposite: to crack and back down. In *The Labyrinth of Solitude*, Octavio Paz explains how the attitude of resignation is rooted in the history of his country:

'Stoicism is the most exalted of our military and politic attributes. Our history is full of expressions and incidents that demonstrate the indifferences of our heroes towards suffering and danger. We are taught from childhood to accept defeat with dignity, a conception that is certainly not ignoble. And if we are not all good stoics like Juárez and Cuauhtémoc, at least we can be resigned and patient and long-suffering. Resignation is

one of our most popular virtues. We admire fortitude in the face of adversity more than the most brilliant triumph' (Paz 1985).

Two-faced attitude, the art of dissimulation is characteristic of the Mexican culture. It is, according to Paz, another mechanism of defence and self-preservation, by which people hide and protect themselves from intruders (Paz 1985). Schneider and Silverman (1997) refer to the term 'role distance' to describe the ability of people to play a role fit for a situation without identifying with the role: 'Formal language, empty phrases, false promises, and even lies, allow Mexicans to meet role expectations without risking their real selves' (Schneider and Silverman 1997).

Oppenheimer (1996) observes that double-talk and deceit has always been a part of Mexico's national character. 'Deceit was the way in which Spanish viceroys defended themselves against kings who demanded ever-growing levies from the New-World, and the Indians' way of protecting themselves against the exploitation of their Spanish rulers'. Mexicans in the colonial days would say yes to everything while doing as little as possible. Centuries later, Mexicans would sum up this national tradition with the saying '*Obedezco, pero no cumplo*' ('I obey, but I don't comply')' (Oppenheimer 1996).

Oppenheimer remarks that this constant simulation attitude still prevails in Mexico, notably in politics: 'Mexicans on the street were so used to being lied to by government officials, that most considered it as given. Polls showed that Mexicans' trust in government officials was only a notch ahead of the faith in car salesmen, who were at the bottom of the list [...]' (Oppenheimer 1996).

c) 'Chingas o te chingan!'

'Chingas o te chingan!' is a very common Mexican saying which basically means 'Fuck them or they'll fuck you!' It sums up an important cultural assumption: in Mexico, the world was perceived as a place divided between rapists and raped, where the first were perceived as winners and the latter as losers. And Oppenheimer (1996) explains that: 'In this context, the maximum values were machismo and the capacity to impose one's will over other, and political chieftains, feudal landlords and unscrupulous business tycoons were perceived as winners in one part of Mexico's collective mind [...]' (Oppenheimer 1996).

Here the emblematic figure of the *macho* surfaces again, the aggressive, hermetic and invulnerable man, who rips open the *chingada*, the raped female, open and defenceless. This 'jungle law' perception of Life, where only the fittest survives helps us to understand the widespread corruption in public or private organisations. When someone reaches a position that confers a certain amount of power (i.e. a politician, a policeman, a secretary...), he or she tries to maximise the benefits that can be made from this advantageous, but probably only temporary situation.

'Was corruption running rampant in most Mexico's law enforcement agencies? Pretty much. According to the Interior ministry's conservative estimates, more than 60 percent of the members of all police forces in the country had received bribes or had criminal records themselves. [...] more than four hundred members of its [Mexico's] Federal Judicial Police or more than 10 percent of the force's personnel – had been fired or suspended from their jobs over the three years ending in mid-1995 because of suspected ties to the drug cartels' (Oppenheimer 1996).

Schneider and Silverman (1997) also point out the severity of police corruption, but they emphasise the magnitude of this phenomenon that pervades most of the country's activity. Corruption spreads in politics, of course, but it 'filters down to lower civil servants, police, judges, business people, and the media' (Schneider and Silverman 1997).

Corruption is not a recent phenomenon in Mexico, but the unchallenged supremacy of the PRI (Institutional Revolutionary Party) in the country has cultivated frauds, bribes and all kinds of corruption for more than 60 years. *Bordering Chaos*, Oppenheimer's acclaimed book on the Mexican political context of the early 90s concisely outlines the organisation of the reigning party: 'Mexico's ruling class was divided into camarillas, or clans, which responded more than anything else to joint business interests or partnerships in corruption. These clans had often originated from ideological allegiances, but had over the years incorporated dinosaurs, babysaurs and reformers alike in defense of their interests' (Oppenheimer 1996).

This section demonstrated that the cultural features identified as significant influences to sanitation development in the three case studies are characteristic of Mexico. They are likely to be present and affecting sanitation development in most parts of the



country. This section also stresses that these cultural factors can hardly be examined as separate and isolated influences because they stem from a common set of symbolic representations, a heritage deeply ingrained in the minds of the Mexican people.

### **3. Political patterns**

#### **3.1. Recurring political features**

##### **a) Lack of political continuity**

In every case study, lack of political continuity was identified at local, municipal and state levels. It is a significant hindrance to the sound management of water supply and sanitation issues.

- In Tepezalá as in San Luis Beltran, the high turnover of the municipal staff or community members involved in water supply and sanitation issues prevents the acquisition of a detailed knowledge of the community natural resources (i.e. river water, groundwater) and the state of the existing infrastructure (i.e. running water network, sewer system, wastewater treatment system).
- In San Luis Beltran, as in the whole state of Oaxaca, the 1990s were characterised by the massive introduction of ecological toilets. The overall results of these sanitation programs were good in San Luis Beltran and throughout the state. However, in the following term of office, the state and community authorities decided to stop promoting this technology and favoured the construction of sewer systems, which are more expensive and represent an incomplete sanitation approach, as no provision was made for wastewater treatment.

##### **b) Short-term planning**

The lack of long-term vision applied to community, municipal and state development was viewed as partly resulting from the absence of political continuity. Short-term planning was identified in each of the three case studies as a major factor affecting sanitation development.

- The level of groundwater depletion in the state of Aguascalientes is considered by Mexican hydrologists as extremely severe (Lagny and Escobedo 1999; Rodriguez, Hernandez *et al.* 1999). Their analysis of the issue has called for long-term

strategies involving the promotion of wastewater reuse, and the optimisation of agricultural water uses. However, so far, the state and municipal governments have ignored these recommendations, favouring short-term solutions (i.e. deeper well drilling, wells relocation).

- Most of the domestic wastewater produced in Oaxaca City and its peri-urban zone is discharged in the Atoyac River, causing such groundwater pollution that some important water supply wells have had to be abandoned. The municipal and state governments have not managed to find a long-term solution to this crucial issue, and yet more sewer systems are being built (i.e. San Luis Beltran), worsening the situation.
- In every case study, sanitation is developed bit by bit, without considering the whole excreta collection-removal-disposal process. In Tepezalá, the municipal government turns a blind eye to the maintenance of the oxidation pond and disregard wastewater reuse issues. In San Luis Beltran, the impacts of the sewer system on water consumption and ultimately on water availability was not assessed, and neither was the underlying wastewater treatment issue.

#### c) Weak institutions

On several occasions, the weakness of the Mexican institutions has been observed, notably with regards to law enforcement, which was found to be inconsistent and was detrimental to the enhancement of community sanitation.

- In Tepezalá, the regulation that prevents the possession of pigs in urban area (Tepezalá is legally urban since its population is more than 2500 inhabitants) and the discharge of manure and wastewater in natural water bodies is not enforced. Though wastewater reuse is mainly practised for the irrigation of cereals, some vegetables are also grown with the poorly treated pond effluent, which is illegal.
- In San Luis Beltran, the laxity of the three last local governments resulted in an unwillingness of the population to meet its legal obligations. Some people do not pay their water bills or their contribution to the sewer system. The *topiles* (community members serving as messengers of the community leader) fail to fulfil

their duty too. The coercive measures and sanctions are not enforced as much as in the 1980s.

- In the Morelos primary school, El Mirador, the director does not manage to maintain order and to compel all the staff members to comply with their professional obligations.
- ADOSAPACO, the organisation that administers water supply in Oaxaca City and in a large portion of its peri-urban zone does not charge all the water users. Failure to recover money from the water users prevents the construction of a wastewater treatment plant for the whole area (including San Luis Beltran and El Mirador).

d) Paternalism

On several occasions, state paternalism has been diagnosed as a disincentive factor dampening people's enterprise and initiative to improve their sanitary conditions.

- In San Luis Beltran, many people voted for the sewer project because it was supposed to be free of charge, all the costs being covered by the public authorities. Expecting the government to solve their problems and somewhat lured by this manna, the community members adopted the sewer project and failed to examine its possible drawbacks in terms of water availability and future wastewater treatment costs.
- For decades, the government has constantly assuaged people's miserable conditions of life by distributing cement bags, basic foodstuffs and other godsend. But these benevolent deeds from the almighty state often lack the follow up necessary to ensure the goods are actually well used. In San Luis Beltran, many community members accepted the bricks, sand and cement offered by the municipal authorities to build ecological toilets. The government did not really assess the actual willingness of the people to use this technology. As a result, several people used the materials to fence their backyards, or use their ecological toilets as storehouses.
- In Tepezalá, the population of Cholula 2 still passively awaits the construction of the sewer system. Despite years of waiting, people still prefer to think, as they have been used to, that the government will finally help them. They can hardly conceive of improving their sanitary conditions by themselves.



e) Decentralisation

The decentralisation of Mexico, one of the most centralised states of Latin-America, is a long and gradual process initiated in the mid-80s. Though this radical political transformation will potentially be beneficial in the long-term, some side-effects of this process have been identified, that indirectly prejudice the development of sanitation.

- Decentralisation involves a transfer of funds and responsibilities from the federal government down to the state and municipal levels. As observed in Tepezalá and El Mirador, there is a lack of expertise at municipal level to deal with these new duties, notably regarding water supply and sanitation issues.
- Through decentralisation, the movement of federal funds increased before they eventually reach the entitled beneficiaries. The frequency of fund diversions by ‘budget nibblers’ is then potentially higher. In the case of the Morelos primary school, El Mirador, decentralisation of the education sector contributed to the development of the teachers’ union. The uptake of this powerful and corrupt organisation on the state education budget has kept on increasing, and has prejudiced the schools, the ultimate beneficiaries.

f) The Ejido

The complex organisation of the ejido, usually overlapping municipal jurisdictions, often leads to fuzzy legal situations that make the management of water and sanitation issues more complicated.

- The unclear jurisdictional status of El Mirador, linked both to Animas Trujano’s ejido and the municipality of Santa Cruz Xoxocotlan created longstanding land ownership conflicts between the community dwellers and the people from Animas Trujano. In addition, this bi-polarity sustained division within the community, which led to a disinterest of the population for Morelos primary school.
- In San Luis Beltran, the river water was formerly granted to the ejidatarios by a presidential decree. Now that most of the land has been sold, only a few farmers remain, but their water uptake is still significant. This creates a conflict with the numerous community dwellers that are desperately awaiting the authorisation for a water outlet by the water committee, with the assent of the ejidal commissioner.

- The work carried out in El Copal was not presented in Chapter 4, since it was the research pilot case study, through which a consistent methodology was developed. Nonetheless, there is one feature of the sanitation system of El Copal that is very relevant to the ejido issue, which is a valuable example to mention here.

The constructed wetland of El Copal was formerly supposed to be built on the land belonging to a community member, who would gain the right to use the treated effluent. The location of that parcel was such that the wastewater treatment system could have worked entirely by gravity forces, without any pumping requirements.

The ejido sector has grown out of the Mexican constitution of 1917, which embodied a strong program of land reform. Under this program, the government granted land and water resources to communities of producers (the ejidos). Unfortunately, the colossal task of land repartition was not completed and lots of land remains unassigned, where communities have grown and claim their ownership. This is the case with El Copal.

Since the landowner was not certain of his ownership of the land, he finally turned down the constructed wetland offer. As a consequence, the treatment plant was built on a parcel further away from the community, which belonged to an inhabitant of the neighbouring village. This did not help to foster the involvement of the population, since none of the community members would benefit from the treated water. In addition, the location of the parcel required the installation of a pump unit to lift the sewer effluent up to the Imhoff tank and constructed wetland. In other words the WWT system became less robust, more expensive (increased capital and operational costs) and less attractive for its beneficiaries.

### 3.2. Transition towards a new political paradigm

#### a) Preamble

The common political patterns presented in the previous section can be analysed in the light of the current changing Mexican political scene. This investigation can reveal that some of the political features impeding sanitation development in Tepezalá, San Luis Beltran, and El Mirador are actually global factors that represent obstacles in the Mexican transition towards a new political paradigm.

b) Decentralisation

The end of the 20<sup>th</sup> century was characterised by a process of democratisation and modernisation of the State in several Latin American countries. Mexico, one of the most centralised countries of the region, took part in this process. In a study examining the transition of Mexican local governments, Cabrero Mendoza (1998) notices that the specificity of Mexico lies in the synchronicity of three processes of change: the democratic transition; the economic transition with the integration into NAFTA; and, the reform of government with the decentralisation of the decision-making process. The latter process has been possible to a great extent due to the transformations that have taken place in the political arena, especially the strengthening of the opposition parties governing many important states and municipalities, including the capital city of the country (Rodriguez 1997; Carrera-Hernandez 1998). This has produced a new context for negotiating intergovernmental relationships. However, the reform of the government with the decentralisation of the decision-making process has been very slow and erratic (Cabrero Mendoza 1998).

The most complete decentralising initiative of the recent years was the one implemented during the governmental period between 1982 and 1988. The series of measures oriented towards the strengthening of state governments included the creation of Committees for the Planning of Development (COPLADES) (Cabrero Mendoza 1998). Since it was created in 1996 and 1997, the grant for Regional Development has been distributed among states on the basis of a formula taking into account poverty indicators. States had to establish a clear methodology to allocate these federal resources among their municipalities (Carrera-Hernandez 1998). At the end of 1997 the Federal Congress (with an opposition majority) introduced the most substantial change in the current federal transfer system in the last seventeen years. The grant for Regional Development was incorporated in the SNCF (National System of Fiscal Co-ordination), which included transfers for education, health and municipal strengthening (Cabrero Mendoza 1998).

Reforms of the Federal Constitution also aimed to provide more autonomy to the municipalities, establishing the public services which can be supplied by the municipal government, as well as assigning them responsibilities for property tax collection and revenue (Carrera-Hernandez 1998).



c) Obstacles to decentralisation

Federalism has meant financial subordination for sub-national levels of government. The central government has taken the most important fiscal capacity, and therefore it possesses the most elastic revenue sources (Rodriguez 1997; Carrera-Hernandez 1998). Although globally the fiscal competence of the local governments increased, this fiscal strengthening was much less significant in municipalities with a low degree of urbanisation, such as Tepezalá, which did not significantly improved their property tax collection. The fiscal dependence of municipal governments in rural areas remains high (Nickson 1995; Rodriguez 1997; Carrera-Hernandez 1998). On the other hand, Cabrero Mendoza (1998) notices that despite the floods of new operative functions, the reforms of the fiscal system have not been launched, restricting the field of action of state governments, which receive more functions than resources. He also disapproves that state governments often monopolise the flow of resources and functions, hardly involving the municipal governments.

Lack of institutional capacity at municipal level is another obstacle to the performance of the decentralisation. Most local governments lack financial, technical and human resources, as observed in Tepezalá, El Mirador, and San Luis Beltran. According to Carrera-Hernandez (1998), municipal governments are often incapable of establishing the rate of property taxation, which is set by the state. Most municipalities lack the administrative capacity and human resources to carry out this function. Most municipalities, and even some states, do not have a proper public expenditure management system and face great difficulties to administer their resources. He also points out that it is very common to find that the official responsible for finance has no basic financial or accounting knowledge, but that he was appointed by the municipal president on the basis of personal acquaintance. Cabrero Mendoza (1998) deplores that the measures for the decentralisation never contemplated specific actions for the administrative strengthening of the municipal level of government.

Cabrero Mendoza (1998) views the lack of political continuity in Mexico as one of the principal obstacles to the institutionalisation of the innovative political experience. 'In Mexico, the municipal level is based on triennial periods of government without immediate re-election, which has, evidently, greatly limited the continuity of the programmes of reform, modernisation and innovation in the local governments. The

design of programs hardly contemplates a greater horizon of time than that of the term of office. This considerably limits the nature of the programmes and their sustainability. Except in some exceptional cases, the political leaders in turn have no particular motivation to perpetuate the success of their programmes. On the contrary, for fear that a changeover of political power between parties might come, they prefer to subtly sabotage the key elements of the implemented innovation, which will make even more evident the failure of the new group in the power, and will leave in the citizens the memory of a good period of government that could not be maintained' (Cabrero Mendoza 1998).

Carrera-Hernandez (1998) also considers this issue and explains that the transfers of federal investment programmes to the states have lacked a clear basis for their allocation: 'This situation weakened the ability of local government to plan in the medium and long term, and in addition, increased their subordination to the higher levels' (Carrera-Hernandez 1998). The lack of political continuity and the prevalence of short-term planning observed in Tepezalá, San Luis Beltran and at state level in Aguascalientes and Oaxaca are thus examples of political features predominant in Mexico.

The investigation also highlighted on several case studies the lack of law enforcement. In his book *Bordering Chaos*, Oppenheimer (1996) presents the impunity of the government officials as an almost constitutional feature of the Mexican political scene. In their presentation of the social structure and group elite of Mexico, Schneider and Silverman (1997) refer to the *compadrazgo*, this patron-client relationship, by which the clients offer their loyalty and services to the local elite, a government official for instance. In return, the 'clients' are rewarded in various ways, depending on the *compadre's* position. For example, they can be exempted from the payment of their water bills, or get registered in the national social security system. From a more political perspective, Cabrero Mendoza (1998) stresses how difficult it is for municipal governments to intervene in the legislative field: 'Although the municipal government can impose regulations, these regulations do not have any important legislative rank, and can be modified very easily. [...] The initiatives of the municipal level in the local congresses carry little weight and, excepting some cases of very important urban municipalities, they are seldom taken into account' (Cabrero Mendoza 1998). Nickson's

analysis of the local governments in Mexico confirms this point, recognising that: 'municipalities may legislate only in a manner backed up by state or federal law' (Nickson 1995).

The vertical functioning of municipal councils is another feature that has prevented the institutionalisation of innovative decentralisation experiences in Mexico since the early 80s. The mayor tends to impose his will and orientation without a real counterweight. Municipal councils have been largely dominated by municipal presidents (Rodriguez 1997; Cabrero Mendoza 1998). Cabrero (1998) also suggests that the vertical style of power is maybe not so strongly associated to the PRI hegemonic government, but with the practices and heritage means of the national culture. This analysis provides some information about the paternalism, which was identified as an indirect detrimental influence on the improvement of people's sanitary conditions in Tepezalá and San Luis Beltran, notably. Adler (2001) observes that the peasant and syndicate paternalism was maintained by the PRI regime as a means to keep the control of the political arena (Adler 2001). Nonetheless, Cabrero suggests that the almighty, emblematic figure of the president of Mexico, and, to a lesser extent, of the governor and the municipal president, nurtured by the PRI regime, might well be rooted far deeper in the history of the country.

#### d) Conversion of the Ejido

The sweeping reforms the government of Mexico implemented since the mid-80s have led to the emergence of an economic system based on market orientation, openness and competition. For the agricultural sector, the new economic paradigm has brought dramatic changes, including trade and price liberalisation and the privatisation of most of the sector's input and output parastatals. To allow the ejido sector to adjust to economic liberalisation, the government initiated a bold program of agrarian reform in the early-90s. The 'Program to Certify Ejido Rights and to Title House Plots' (PROCEDE) originated in late 1992. Despite this new legal and institutional framework designed to support land transactions in the ejido sector, the majority of transactions are informal and are not always properly recorded at the ejido level, let alone with the National Agrarian Registry (RAN) (unpublished data). This lack of clarity with respect to land ownership is thus a widespread issue that can be generalised from the



investigation of El Copal (pilot case study) and El Mirador to a vast number of rural and peri-urban localities in Mexico.

Lack of political continuity and short-term planning were identified in the three case studies as significant factors affecting sanitation development. This section pointed out that these features are actually characteristic of most Mexican institutions. Poor law enforcement also turns out to be a widespread manifestation of the weakness of the Mexican institutions. The literature suggests that this lack of power at local level partly stems from a lack of financial, technical and human resources. This section also underlines that paternalism and the legal fuzziness associated with the conversion of the ejido are features that pervade the politico-legal landscape of Mexico.

## **4. Urbanisation**

### **4.1. Recurring features**

#### **a) Rural exodus and population growth**

Rural exodus was accompanied by a decline in the economic activity of rural areas and largely contributed to the demographic explosion of the peri-urban zones. Sanitation development in the three case studies seems to be closely associated this process.

- The cities attract the wealth and the workforce. In Tepezalá the local economic activity is very low and most workers commute everyday to Aguascalientes City. The municipal budget is calculated as a function of the wealth produced locally, the authorities have little money, which they need to distribute among the various localities of their jurisdiction. This partly explains why Cholula 2 has not got a sewer system yet, and why the two parallel sewer networks have not been connected.
- In peri-urban zones, such as El Mirador and San Luis Beltran, rapid population growth becomes synonymous with high dwelling density. Consequently, there is less space to spread the ecological toilet compost. In addition, open-air defecation becomes less practicable and more troublesome for the neighbourhood, like the nuisances caused by inadequate or ill-operated on-site sanitation system. In this context, the sewer system appears to be the most appropriate alternative for many people.

- Population growth in Oaxaca City and its peri-urban zone poses several water and wastewater management issues: the volume of domestic wastewater discharged into the Atoyac River and its tributaries is such that the underlying aquifers used for domestic water supply are getting seriously contaminated. In addition, the combined effects of population growth with the extension of sewer and running water networks provokes a situation of water scarcity in the metropolitan zone. This state of affairs prompts the politicians to manage water supply and sanitation issues in a more integrated way.
- In El Mirador and the surrounding communities that mushroomed during the late 80s and 90s, the water supply and sanitation infrastructure is very precarious but the municipal and state authorities cannot cope with the overwhelming needs of populations that grew at a rate as fast as 12 percent annually.

b) Cultural shift

The cultural values, behaviours and expectations of the people who come from rural areas are challenged as soon as they settle in the peri-urban zone. The same phenomenon occurs when the extension of the urban zone brings the urban world to a greater proximity.

- The disintegration of the ejido caused the people to move towards the urban environments, gradually adopting the way of life of the city dwellers. The ecological toilet and other on-site sanitation systems tend to be viewed as technologies for the rural world, and for the poor. The lure of modernity, of the ‘flush and forget’ sewer system technologies was observed in each of the three case studies.
- In San Luis Beltran, the increasing closeness of the city allowed the people to shift from subsistence agricultural activities to a wide range of jobs in the city. Formerly, the agriculture contributed to strengthen the community social fabric, since people had to rely on each other for labour. Now that agriculture is a marginal activity, the community dwellers are more independent, and their involvement in community matters declined. This affected the authority of the local government and caused community participation to decrease. The same remark applies to El Mirador, whose inhabitants depend little on their community to make a living.

- The cultural shift associated with the exodus to the urban environment or with the increasing proximity of the city is more acute in the case of El Mirador and its neighbourhood. Most of these communities are less than 10 years old and consist of an amalgam, a melting-pot of poor rootless people from various origins, religions, language, and customs. In such a harsh social environment, the integration and the involvement of the population in the community is a long process, especially if efficient leadership is lacking, as in El Mirador. Failure to create a community spirit affects the development of the water supply and sanitation infrastructure, since municipal support and the contribution of the dwellers remains limited.

## 4.2. Chaotic peri-urban zone development

### a) Preamble

The previous section highlighted some demographic and socio-cultural factors common to El Mirador and San Luis Beltran. This section examines if these similarities are mere coincidences, or if these factors influencing sanitation development (rural exodus, population growth, and cultural shift) are intrinsic characteristics of a more global pattern: urbanisation and the chaotic development of the peri-urban zones in the Third World.

### b) Migration and population growth in the peri-urban zone

Migration of ejidatarios towards the cities was viewed as a significant contributor to population growth in El Mirador and, to a lesser extent in San Luis Beltran. This phenomenon cannot be widely generalised. Unpublished data compiled in 1999 by a large and respected international organisation suggest that migration from the ejido community appears limited and lower than originally expected. According to this study, most households have chosen to participate selectively in migration, with one or more (but not all) of the household members migrating, particularly to the U.S.

Nonetheless, the deterioration of the sanitary conditions in fast growing peri-urban environments is a global phenomenon that affects most cities in developing countries. The gravity of the sanitary conditions of the urban poor was already reported by the World Health Organisation at the end of the 1980s. The Organisation pointed out that the rapid demographic growth was not only confined to capital cities and large metropolitan areas. It also affected secondary and tertiary cities, often outstripping the



ability of urban services to keep pace and forcing large portion of their populations to live in poverty and squalor. The report also underlined that the urban poor are 'at the interface of underdevelopment and industrialisation, and their disease patterns reflect the problems of both. From the first they inherit a heavy burden of communicable disease and malnutrition, while the second brings its typical spectrum of chronic and social diseases' (Tabibzadeh, Rossi-Espagnet *et al.* 1989). Similar conclusions have been drawn from the Mexican situation. Saade Hazin (1997) observed that the growing population, as well as the economic development, experienced in Mexico over the recent decades has led to growing pressures on the environment. Economic development and demographic growth are concentrated in medium-sized and large cities whose authorities face the challenge of increasing and improving the provision of services (Saade Hazin 1997)

c) Conventional sanitation: the lure of modernity?

The sanitation model 'cistern toilet-sewer system-wastewater treatment plant' has become the conventional approach in Mexico. These high technology systems have been quite successful in western societies, allowing the cities to grow, removing faecal contamination sources away from the population. This approach has been transferred to less developed countries, such as Mexico, through colossal international loans, for the benefits of the population and a few western companies, experts in this domain. However, in the case of Mexico, the facts show that these technology transfers were not very productive. According to the National Water Commission, out of the 1,000 municipal wastewater treatment plants, 223 are out of operation. Most of the existing wastewater treatment technologies are used (CNA 2000). The wastewater treatment capacity in Mexico is very limited and additionally, the existing infrastructure is not fully exploited (Saade Hazin 1997). It is not so much a problem of technology, because, as Lafourcade (2000) reckons, all the possible and imaginable types of systems are represented in Mexico but they do not work (Lafourcade 2000).

What keeps the government officials from re-orientating their sanitation approach and looking for alternative, cheaper, more robust and sustainable options? Several factors are involved, but it is probably sensible to point out that this fascination for the 'high-tech' western way of life is also perceptible amongst most of the population, including

the migrants of the peri-urban zones. People, who lived in rural areas using on-site sanitation facilities, come to the metropolitan zone and feel the urge to get their cistern toilet connected to the sewer network. Community dwellers and politicians seem easily lured by the sewer system, as they fail to realise that this efficient way of removing excreta and faecal pathogens is an incomplete and deficient sanitation approach without wastewater treatment.

d) Declining community involvement

The investigation in San Luis Beltran showed a decrease in the involvement of the population in the community matters, which contrasts with the mutual help traditions that prevailed in the region since the Pre-Hispanic period, and in the village during most of the 20<sup>th</sup> century. Since 1994, the share of households involved in off-farm activities rose by 50 percent, reaching 60 percent of all households in 1997. The largest increase in labour was directed towards the non-farm sector (unpublished data). This supports the observations made about San Luis Beltran and El Mirador, where an increasing part of the population now works in Oaxaca City and depends less on the community (for mutual help in farming, for instance).

El Mirador is typical of peri-urban communities that mushroomed around big cities since the 1970s. Poverty, the multi-ethnic environment and lack of strong leadership maintains mistrust among the population of this community, keeps the social fabric loose and restricts the involvement of its dwellers in associative actions. This problem is not specific to El Mirador. UNDP recently pointed out that the continuing concentration of the poor in urban areas 'exacerbates many problems, including marginalisation, security and, not infrequently, community tensions' (UNDP 2001). UNDP policies strongly encourage initiatives supporting the creation of an enabling environment for enhanced participation. This suggests UNDP regards the lack of social capital in peri-urban zones, which is manifest through low levels of community involvement, as a strategic aspect of development in general.

This section showed that the patterns associated with urbanisation in San Luis Beltran and El Mirador case studies can be generalised to most of the peripheral communities of the Third World cities. These environments are often characterised by weak social networks and little organisation and involvement of the people in their community. As

people live closer to the city, they expect to get more comfort at home, and this notably involves an access to the sewer system. High population densities make the sewer system a very attractive alternative both for the public authorities and for the beneficiaries. Building a sewer system becomes cheaper in high-density zones and it allows the government to deal quickly with the poor sanitary conditions of a growing population. In these densely populated environments, on-site sanitation systems such as pit latrines or the ecological toilet require extra care, or they quickly become a nuisance for the neighbourhood.

## **5. Economic patterns**

### **5.1. Recurring economic aspects**

#### **a) NAFTA and the collapse of the ejido**

The North American Free Trade Agreements had a very deep impact on Mexican agriculture, severely affecting the ejidatarios who lived on the culture of rain-fed maize and beans. NAFTA had an indirect impact on the sanitation systems of several case studies.

- San Luis Beltran used to be a community of peasants, but nowadays only about five old farmers remain. The pressure of NAFTA partly caused the ejidatarios to sell their lands. As a consequence, fewer and fewer people have a use for the ecological toilet compost, and this valuable fertiliser becomes a nuisance for many users.

#### **b) People's poverty**

The general state of poverty of the people from Tepezalá, El Mirador, and San Luis Beltran certainly plays a major role in impeding the improvement of their sanitary conditions. It is significantly responsible for the lack of enhancement of the domestic sanitation facilities and partly explains why many people still use inadequate pit-latrines or practise open-air defecation in these three communities.

- In Tepezalá, only one of the four farmers practising wastewater reuse owns a reservoir to store the pond effluent. The others cannot afford to build such a basin, which extend the biological wastewater treatment duration, and can significantly reduce the contamination risks associated with pond effluent reuse.



- In El Mirador, the extension of the sewer system to the whole community is hardly economically feasible, since part of the population cannot afford the financial contribution required by the municipal authorities. In the Morelos primary school, the person in charge of the cleaning of the latrines quit her job, since some pupils' parents stopped paying her. The lack of toilet paper provision and soap and water for handwashing are also symptomatic of the acute poverty and marginality (very much related in that case) of part of the population living in El Mirador and its neighbourhood.

c) State and municipal resources constraints

The consideration of the overall municipal and state economical backgrounds of each case study is also of paramount importance to comprehend the obstacles to sanitation development.

- Oaxaca is one of the four poorest states of Mexico and is highly dependent on federal funds for its development. The urbanisation phenomenon boosted in the 1980s and 1990s has put much pressure on the state government, that could not meet the basic water supply and sanitation requirements of the populations settling in the metropolitan zone. Lack of state and municipal financial resources is a reason why the long-awaited wastewater treatment plant has not been built yet to treat the sewer effluents of Oaxaca City and its peri-urban zone, including El Mirador and San Luis Beltran. It also accounts for the difficulties met by the state education office to improve the infrastructure in the primary schools of the peri-urban zone of Oaxaca City.
- Aguascalientes is a rich state of Mexico, but Tepezalá is one of its two poorest municipalities and its remote location from Aguascalientes City excluded it from the economical boost triggered by the industrial investments of the last two decades. Tepezalá remains a poor rural village, with virtually no economic activity, and this affects the ability of the local government to undertake significant sanitation improvement in the whole district. It partly explains why the oxidation pond is not being maintained or upgraded, why the sewer system is not installed on the rocky slopes of Cholula 2, and why the sewer system of Cholula discharges into the river rather than into the pond.

- Generally speaking, the lack of financial resources hinders the design of comprehensive sanitation solutions. Piecemeal sanitation development scenarios, such as: the construction of excreta collection facilities first, followed by the installation of a sewer system, in the expectation of a future hypothetical wastewater treatment plant is partly due to the inability to cope with the financial requirement of a global plan.

## 5.2. Unfavourable economic environment

### a) Poverty in Mexico

As Oppenheimer (1996) described in his book *Bordering on Chaos*, Mexico's gross domestic product barely reaches 5 percent of the U.S. economy and amounts to that of the state of Ohio (Oppenheimer 1996). In the mid-80s reports from the World Bank (1995, 1996) suggested the existence of a 'poverty trap' in Mexico. While the investigation carried out on poverty in 1997 does offer some evidence of inertia in emerging from poverty, it does also suggest that the poverty trap may not be as closed as earlier perceived. The probability of being poor in 1997, taking all other explanatory variables at their means, is 27 percentage points higher if the household was poor in 1994 (World Bank 1995; World Bank 1996). Poverty in rural Mexico is pervasive and severe. In 1994, 47 percent of the ejido households were below the poverty line and 34 percent were in extreme poverty (de Janvry, Gordillo *et al.* 1997).

### b) Wealth distribution inequalities

By the early nineties, according to Oppenheimer (1996), the wealthiest 20 percent of the population was receiving 54 percent of the country's income, while the bottom 20 percent was getting only 5 percent of it. Oppenheimer stresses that in this context of generalised poverty, the government was doing nothing to reduce the rapidly growing gap between the rich and the poor. 'The government assured several of the business barons a longterm monopoly over their respective industries and overt or disguised government protection well into the NAFTA era. Under the free-trade agreement that went into effect on January 1, 1994, key Mexican industries-mainly those of the Mexico Twelve (the best known billionaires of the country) were assured government protection for up to fifteen years' (Oppenheimer 1996).

Mexican wealth is not only unevenly distributed among its people, but great regional disparities between North and South Mexico also prevail. Oppenheimer (1996) points out that Mexican people themselves describe their nation as three countries: Mexico's industrialised north, centred in Monterrey, a rapidly modernising region; central Mexico, dominated by the capital in its geographic centre; and Mexico's southern belt of poverty-stricken states, including Chiapas, Oaxaca and Guerrero. 'Chiapas was one of Mexico's richest states in natural resources, yet its population was ranked along with that of Oaxaca and Guerrero among the country's poorest. Chiapas supplied nearly 60 percent of Mexico's hydroelectric power, 47 percent of its natural gas, and 21 percent of the country's oil, and was one of Mexico's top producers of lumber, coffee, and beef. Yet, about a third of all households in the state did not have electricity, and half of its population did not have access to drinking water. [...] In Nuevo León (North Mexico), life expectancy was 73 years, and the average schooling was 7.4 years, whereas in Chiapas and Oaxaca, life expectancy was barely 67 years, and the average schooling was 3.9 years.' (Oppenheimer 1996)

Oaxaca thus appears as one of the less industrialised and poorest states of Mexico. Consequently the state and municipal governments have much less financial resources than the corresponding state and municipal authorities of the northern part of the country. They highly depend on the federal government's resources. Due to the great regional wealth disparities amongst the different regions of Mexico, the conclusions drawn from San Luis Beltran and El Mirador case studies (state of Oaxaca) should not be extrapolated to all the states of the country. Correspondingly, Tepezalá is the poorest municipality of the state of Aguascalientes and does not typically portray the economic conditions prevalent in the rest of the state.

c) Drastic economic reforms plunge the ejido sector in crisis

During the 1990s, the ejido sector faced two important and almost simultaneous reforms. The Second Agrarian Reform of 1992 officially ended the era of land reform and removed most restrictions against land transactions and participation in labour markets. Then, the economy wide and agricultural economic liberalisation programs that began in the late 1980s were reinforced in 1992 with the passage of NAFTA. Both



sets of reforms were unfolded into a difficult economic environment, which would increase the challenges for adjustment (unpublished data).

Faced with this unfavourable legal and economic background, ejido households have increased their involvement in off-farm activities and migration. Many ejidos have divided their communal land among their members, notably to grant them individual ownership of the land under the PROCEDE land-titling scheme. However, land purchases were not a primary factor behind this accumulation of land assets (unpublished data). This information suggests that even though the fragmentation of the ejido and individual land titling is a general trend, it does not always result in the selling of land and its conversion into residential lots. The situation of San Luis Beltran and El Mirador is characteristic of the changes in the ejido sector in the peri-urban zone of large cities essentially.

## **6. Conclusion**

The analysis of the data collected in Tepezalá, El Mirador, and San Luis Beltran suggested that despite their differences, the three case studies shared many characteristics. Some of the cultural factors affecting sanitation development, such as corruption, the two-faced attitudes, mistrust, machismo and resignation, are shown to be typical features of Mexican culture. They can be better understood from a historical perspective, in which the colonisation period plays a notable role.

Likewise, the factors identified during the fieldwork as political impediments to sanitation development (lack of political continuity, short-term planning, law enforcement, paternalism, the ejido) do not seem to be specific to the three case studies investigated. They are part of the political heritage of Mexico, which the PRI regime significantly contributed to, and some of them represent obstacles for government reform (through decentralisation) and the democratic transition of Mexico.

With the exception of the rural exodus due to the collapse of the ejido, most of the demographic and sociocultural features identified in El Mirador and San Luis Beltran (e.g. immigration, population growth, lack of strong leadership and community involvement) are not specific to the peri-urban zone of Oaxaca. They are more globally associated with the urbanisation phenomenon and the further expansion of the Third

World metropolis. The deterioration of sanitary conditions and the difficulty to cope with the urgent need of water supply and sanitation infrastructure in these fast growing human settlements are major issues faced by most governments in developing countries.

The examination of the economic features common to the three case studies revealed that some generalisations would be misleading. The levels of economic activity and poverty are heterogeneous throughout Mexico. El Mirador and San Luis Beltran belong to one of the poorest region of the country and Tepezalá is quite a marginal municipality of Aguascalientes State. Nonetheless, the impact of NAFTA on the agricultural sector, the inequality of wealth distribution among the population, and the low fiscal capacity of the municipalities are features that can be observed consistently in rural and peri-urban zones throughout the country.

The synthesis undertaken throughout this chapter demonstrates that most of the similarities between the three case studies are not merely coincidences, but they often form part of more general patterns that permeate Mexico. A deeper study of the impacts of these macro economic, political, and sociocultural patterns on sanitation development could enhance the understanding of this issue at local level. Although this chapter tackled these themes separately and in a linear way, their inter-relatedness is implicit, which supports the choice of systemic approaches to address them in a more comprehensive way.

# Chapter 6 - Utility and Validity of the Conceptual Maps

## 1. Introduction

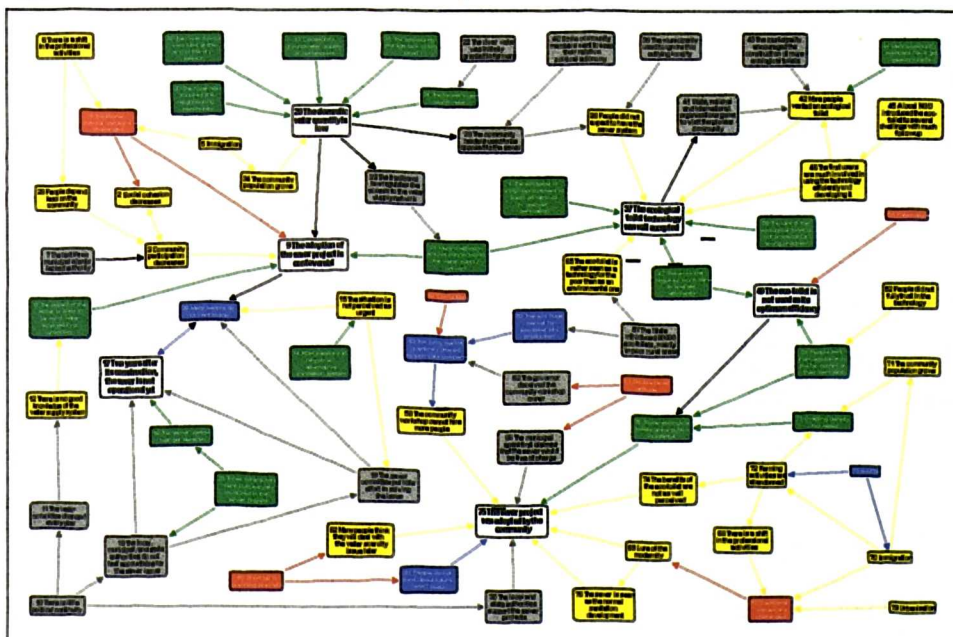
While the prior chapter discussed the patterns common to the case studies' conceptual maps, i.e. their content, this chapter examines the conceptual maps *per se*. The first section deals with the information that is perceptible at first glance when looking at a map. The next part explores the conceptual maps in more detail, analysing at a subtler level their structural patterns, their weaknesses, and drawing some analogies with geographical maps. The last section assesses the spatial and time validity of the conceptual maps.

## 2. Overall maps at first glance

### 2.1. Colour mosaic

A mosaic of colours, one that is perhaps overwhelming, is what most people immediately perceive when presented with the overall map of a case study (see Figure 6.1.). The mix of colours is what strikes the eyes first. Then the brain starts examining the concept-boxes and analysing the relationships, trying to make sense of this complicated graphical representation.

Figure 6.1. San Luis Beltran's conceptual map





The conceptual map instantly reveals the complexity of the sanitation issue and the diverse nature of the factors influencing it. Although it might seem trivial, it is of importance in the context of this study. The conceptual map shows the diversity of factors that influence the development of sanitary conditions in a community, and as a consequence, it supports the need to call for *multidisciplinary* approaches to its management.

## 2.2. Interconnectedness

Another feature of the map is also apparent straight away: the colour boxes stand as nodes on a dense web that links them altogether. The conceptual map highlights the interconnectedness of the factors influencing sanitation development. It demonstrates that issues, which are usually addressed separately through distinct disciplines, are actually closely related and interact with one another.

The fact that technical and economic issues, or economic and political issues, for instance, are interdependent is not a novelty. But to show on one diagram the relationships amongst social, cultural, technical, political and economic factors influencing sanitation development is new. It supports the idea that multidisciplinary teams are not enough to address the sanitation issue seriously: interaction is needed, *interdisciplinary* approaches are required.

## 2.3. Colour balance

The colour balance of each map provides some information about the predominance of certain types of issues affecting sanitation development. Some case studies have more green boxes-technical factors affecting sanitation development- than others do. This is the case of Tepezalá, where the technical shortcomings in the sanitation infrastructure (i.e. sewer pipe crack, very low efficiency of the oxidation pond, discharge of Cholula' sewer in the riverbed...) are numerous.

The overall maps of El Mirador and San Luis Beltran show a greater colour balance. Nevertheless, in the case of El Mirador, the boxes are somewhat grouped in distinct areas of the map. The technical, political and social issues seem to be more separated. This is presumably due in part to the scale of the investigation, which was limited to the school sanitation system. The state and municipal political factors, as well as the

community social factors did not directly influence the choice of the school sanitation facilities and the way they were built. Instead, these influences affected the development of sanitation in El Mirador and the involvement of the population in the Morelos primary school. This argument can be tempered by the fact that the conceptual maps developed in this study are flat, in two dimensions. The readability of the map was a criterion determining the arrangement of the concept-boxes. The main objective was to avoid excessive link criss-crossing. In the case of El Mirador, this resulted accidentally in a 'green zone' on the right hand-side of the map.

In the light of this, the interpretation of the map colour balance requires caution. When each colour is well scattered over the map, it may indicate a high degree of interconnectedness among issues of different natures. On the contrary, if the grey, yellow and green patches are found on separate areas of the map, it can suggest a higher degree of independence amongst political, social and technical factors. Nevertheless, these hypotheses need to be ascertained through a deeper insight into the map structure. Could the concepts be positioned according to a conformation that would modify the colour balance? Is the separation of the political, social and technical issues a graphical illusion, or does a closer analysis of the relationships confirm this hypothesis? This stage involves a closer analysis of the map, which is beyond the range of information perceived at first glance. The next section examines such features, which arises through a more detailed analysis of the maps.

### **3. Learning more from the maps**

#### **3.1. Structural patterns**

A closer observation of the conceptual maps leads to the identification of key concepts, which are of particular interest in the comprehension of the sanitation issue. These concepts are related to numerous factors (up to nine links). Many of them are *Nodal Factors* represented by a white concept-box and a larger font-size. They were defined, at the beginning of Chapter 4, as leading concepts of the map. The recognition of the key concepts helps to frame the map and allows the reader to step back from the single concept-to-concept causal relationships. Nodal factors often essentially report on the global sanitary situation such as: '*Sanitary conditions in the northern part of Tepezalá*

*do not improve*' (concept 7, Tepezalá) or *'Community water supply and sanitation infrastructure do not develop*' (concept 4, El Mirador). They can be viewed as mainly the final outcomes of long causal chains. However, in many cases, key concepts correspond to crucial aspects of the system, which have decisive impacts on sanitation development: *'Parents do not participate actively in the development of the school*' (concept 14, El Mirador), *'The domestic water quantity is low*' (concept 20, San Luis Beltran). It would be erroneous, nevertheless, to consider these factors as the most influential. Indeed, some concepts appear less central on the maps, positioned on the edges, and have fewer links with other factors. This is the case for concepts like *'Corruption*', *'Immigration*', and *'Lack of political continuity*'. These concepts are at least equally significant, but their influence on sanitation development is less direct, and for readability purpose (i.e. to avoid criss-crossing), they often appear several times on the same map. If the links of *'Corruption*' replicates were all summed up, this factor would actually share the characteristics of key concepts. This point is further examined in the section 3.3 of this chapter.

### 3.2. Cycles

The in-depth exploration of the conceptual maps leads to the identification of cycles, which are either positive or negative feedback loops. Positive feedback loops are made of positive causal links only, or include an even number of negative links. These loops amplify the change of the variables and have a destabilising effect, favouring change within the system. At the opposite, negative feedback loops (including an odd number of negative arrows) reduce the opportunities for change by stabilising the concepts.

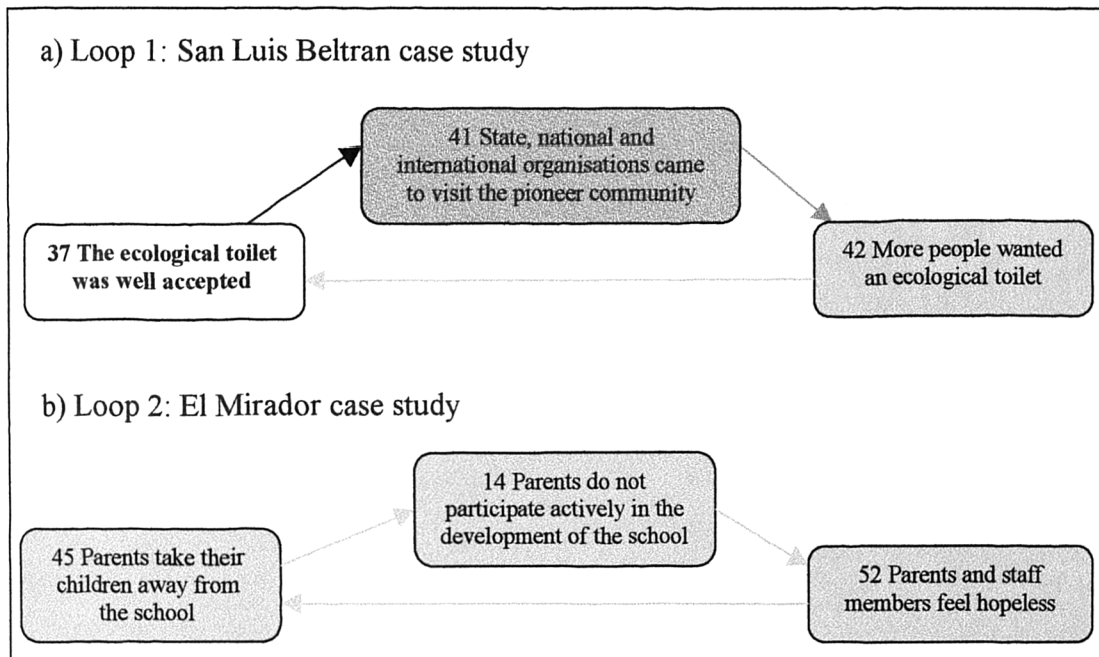
The three maps developed in this investigation include several cycles. All of them are positive feedback loops describing unstable, changing situations. Most of them actually only consist of two concepts forming a loop. For instance, in the Tepezalá case study, *'38. Regional aquifers are depleting critically*' causes *'61. Deeper wells are drilled*', which feeds back *'38. Regional aquifers are depleting critically*', and so on.

Figure 6.2 shows two examples of positive feedback loops that involve fewer concepts. In the first example, the initial good acceptance of the ecological toilet by the 'pioneer' group of San Luis Beltran leads to a growing interest from municipal and state authorities, as well as international organisations in that successful experience. The



concern of third parties motivates other community members to adopt the ecological toilet technology. The acceptance of the sanitation facility in the community increases. This cyclic process is one of growth, which allowed the development of the ecological toilets in San Luis Beltran during most of the 1990s.

Figure 6.2. Positive feedback loops



The second positive feedback loop presented in Figure 6.2.b. is abstracted from the El Mirador case study (the Morelos primary school). The lack of parents' participation in the school matters causes the hopelessness of the parents that are most involved in the school and of part of the staff too. This state of discontent drives many parents concerned by the education of their children (and some valuable teachers) to change school. This affects the involvement of the parents in the school. This cyclic process is also unstable since it leads to the continuous loss of elements that participate significantly in the enhancement of the school. Nevertheless, population growth in the neighbourhood of El Mirador, and the proximity of the Morelos primary school for this population compensate for the instability of the system, as 'new blood' parents register at school each year.

The recognition and the analysis of cycles in the map can lead to a better understanding of certain aspects of the sanitation system dynamic. The phase that naturally follows this consists of the identification of the modifiable variables of the cycle, that is, aspects

of the system that can be influenced. Projects can then launch measures aiming to change the dynamic of the cycle. The possible applications of the conceptual maps will be developed in more detail in Chapter 8.

### 3.3. Representational shortcomings

Conceptual maps are a convenient means of representing the interconnectedness of the components of a system. However, they also present several shortcomings that can bias and distort the reality in a misleading way.

A first deficiency relates to the relative size of the concept-boxes. Some ideas require almost a full sentence to be expressed accurately while others can be summed up in one word or two only. The size of the concept-box varies accordingly, and large boxes naturally tend to attract more attention than smaller ones, regardless of their real significance in terms of influence on sanitation development. Some concept-boxes are labelled with a single word, like '*Corruption*', '*Paternalism*' or '*N.A.F.T.A.*', but their impact on the sanitation system is very significant.

Other weaknesses of the conceptual maps developed in this study stem from the flatness of these representations. The eyes tend to give less importance to the peripheral areas of these two-dimensional images. The factors situated on the edges of the maps have generally indirect influences on sanitation, hence their peripheral position. Nonetheless, the magnitude of their influence on sanitation development can be severe. In the case of San Luis Beltran's map for instance, the concepts '*10. There is little political continuity*', '*79. Urbanisation*', and '*80. Short-term planning prevails*' are respectively situated at the bottom left corner, bottom right corner, and bottom edge of the map. In Chapter 5, the discussion of these factors that are common to several case studies stressed their high significance, which contrasts with their marginal positions on the map.

The two-dimensional nature of the conceptual maps also required, for readability purposes, the repetition of certain factors in order to avoid excessive link criss-crossing. This would probably not be necessary in a three-dimension representation. If, for instance, the map were spherical, the bias associated to the neglect of the periphery concepts would vanish.

### 3.4. Geographic map analogies

It can be interesting to draw analogies between conceptual maps and geographic maps. Both of them incorporate a wide range of information: geographic maps can show land-uses, communication networks, human settlements, and watercourses. Similarly, the conceptual maps developed in this study embrace different kinds of factors affecting sanitation development. An analogy can be drawn between geographical and conceptual maps with respect to scaling. Geographical maps exist at different scales, e.g. country, regional, or local scale. A large-scale map shows a small area with a large amount of detail. The smaller the scale gets, the more the map shows the organisation of the whole, how the parts fits together: for instance, the river, from its source in the mountains, along its tributaries and the cities it flows through, to its discharge in the sea. The smaller the scale, the more apparent are the communication networks, the relationships between geological formations... Similarly, in this study, the conceptual maps can be seen at different scales: small scale, i.e. overall map, or larger scales, i.e. sub-maps and connection groups. The overall maps show the whole system. They show all the factors that have some influence on the development of sanitary conditions, and how these parts interact. Although they contain all the information of the sub-maps and connection groups, the latter are more appropriate for the examination of small aspects of the map and the way they relate to the network neighbourhood.

Contour lines allow the geographical maps to provide information about the land relief. Could this topographic information be transferred to the conceptual map to let the reader explore the 'peaks' (i.e. the most significant influences) and the 'valleys' (i.e. the flows of influence) of the sanitation system? Theoretically, it should be possible to assign a magnitude value to each factor, that is, to rank them according to the significance of their influence on sanitation development. It could help the recognition of the most sensitive issues, and would counteract the representation biases associated within the location of concepts on the edges and the concept-boxes' size. Nonetheless, in practise, to estimate the magnitude of each factor appears extremely difficult and involves much subjectivity. Besides, unlike mountains and valleys fixed in space, concept-boxes can be rearranged in different ways, consequently it would be misleading to derive conclusions from the overall conceptual map landscape. Another point is that physical landscapes are quite permanent, while some parts of the conceptual maps are

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very dynamic: cultural and economic factors might be persistent, but social, technical and political (especially in the current Mexican context) factors are transient. Consequently, a topographic representation of sanitation development could freeze the dynamic of the system.

## **4. Validity**

### **4.1. Spatial validity**

The discussion of the methodology followed throughout this study is the objective of the next chapter. Nonetheless, it appears relevant to examine in this chapter the spatial and time validity of the conceptual maps as a means of representing the factors influencing sanitation development.

The spatial validity of the maps has been partly assessed in the prior chapter dealing with common patterns. A number of factors identified in the three case studies were shown to be representative of general trends in Mexico. This is true for cultural and political factors, but also for economic and social features. The fact that aspects, that were deemed important enough to be part of the maps, had already been identified and analysed by the scientific community as features of global patterns certainly gives some credibility to the results of this research.

However, the analysis of the common patterns presented in Chapter 5 also warned against excessive generalisation. The economic, social and cultural context varies greatly from one part of Mexico to another, from the urban, to peri-urban and rural environments. Mexico is often regarded as a compound of three countries, North Mexico, Central and South Mexico, which indicates much about the diversity of the country. The three case studies of this research were located in a rural zone of Central Mexico and in a peri-urban zone of south Mexico. By no means all the conclusions drawn from this research should be applied to all Mexican communities.

Conceptual maps are versatile. All that is deemed relevant by its developer(s) can be incorporated into them. A map can integrate macro-economic and political aspects, and in addition to general cultural features of a region or a country, it can include aspects that are specific to the local background. Factors common to several case studies were shown to have often a crucial influence on sanitation development. Nevertheless, it is

particularly important to represent the specificity of each case study, since it is usually easier to make some change occur locally. Furthermore, sustainable sanitation development requires solutions that are appropriate to the very specific conditions of each site. The choice of the system components is a crucial phase: although regional and national influences might be prominent, they should not mask local factors. The subjectivity inherent in this selection process will be discussed in Chapter 7.

#### 4.2. Time validity

Given the focus of the investigation on sanitation development, the evolution of the sanitary conditions and sanitation infrastructure was reviewed, at least since the early 80s. Significant factors rooted in the past that still have some influence on current sanitation development were incorporated in the maps, since they are crucial for a good understanding of the prevailing situation. Nonetheless, the conceptual maps presented in this research are like snapshots taken during the period of investigation of each case study. The sanitation system is dynamic and the three ‘pictures’ taken between October 1999 and January 2001 might already be partly outdated. Though some trends can be estimated from the analysis of the maps, and despite the dynamic processes they describe, the maps can hardly anticipate the future. Ideally, conceptual maps should be used in combination with predictive tools, but these issues will be addressed in more detail in Chapter 8.

### 5. Conclusion

The examination of the features of the conceptual maps developed in this study revealed *their strengths and shortcomings*. Conceptual mapping proves suitable to represent the sanitation development issue, as investigated through a systems approach. It highlights the diversity and the interconnectedness of the factors influencing sanitary conditions. The network, web-like representation of the issue provides a means to overcome, at least to a certain extent, the process of fragmentation, and the habit of splitting up a complex issue in several separate disciplines. This is the main strength of the overall maps. The detailed analysis of the maps is facilitated by the use of sub-maps. They lead to the recognition of important aspects of the systems (nodal concepts, cycles) and allow a more practical examination of the causal chains.

Nonetheless, the flat, two-dimensional nature of these maps tends to freeze the representation of the issue, which can lead to misinterpretations. In addition, the conceptual maps developed in this study do not provide much information about the relative significance of the factors and their relationships. Although they are valid representations of the situation in El Mirador, San Luis Beltran and Tepezalá, they focus on the recent evolutions of their sanitation systems and bring no clue to the future development of their sanitation systems.



## Chapter 7 - A Holistic Approach: Discussion

### 1. Introduction

This chapter deals with the notion that the description of the world cannot be achieved with absolute objectivity. The shift from the Cartesian Newtonian paradigm leads to the recognition that the knowledge and the understanding of life are relative in essence (c.f. chapter 2 section 5.2.). This part of the study discusses the implications of this concept on the validity of the fieldwork and on the holistic approach followed to represent the issue of sanitation development in three Mexican villages. The first section of this chapter examines the subjectivity associated with qualitative research. The second section deals with the relativity of knowledge and shows that different (and sometimes contradicting) meanings can be given to sanitation and sanitation development. The third part presents a critique of the holistic approach followed in this investigation. Finally, the transferability of the approach is discussed.

### 2. Observer bias

#### 2.1. Qualitative research

Qualitative researchers consider that the influence of the researcher on the outcome of the experiment is meaningful. The observer, with his or her personality and culture, is part of the experiment and interacts with the reality. Though parts of this investigation were framed in advance, such as the aims and objectives, and the criteria for case-studies selection, the direction of the qualitative research developed rather spontaneously. For instance, relationships with interviewees or with people out of the research arena often resulted in contacts with new informants.

Qualitative researchers assume it is impossible to eliminate the effect of the researcher completely. A qualitative researcher takes advantage of personal insight, feelings and perspective as a human being to understand the social life under study, but is aware of his or her values or assumptions. He or she takes measure to guard against the influence of prior beliefs or assumptions when doing research. Rather than hiding behind 'objective' techniques, the qualitative researcher is forthright and makes his or her values explicit in a report' (Neuman 1997).

The methodology of this investigation was developed so to keep the research process as transparent as possible (c.f. Chapter 3 section 2.4.). The log-sections of the interview transcripts provide information about the observer-interviewee interaction. Case study synthesis reports, all the interview transcripts as well as the files presenting the map development phase are also available for consultation on the attached CD-ROM.

## 2.2. Influence of the literature review

Literature review normally forms part of the scientific research process, and qualitative research is no exception. In this study, the literature review was initially a means of introduction to several topics, such as development, sanitation, Mexico, its history, its people, from a wide range of perspectives. Throughout the research, reports, books and articles were also consulted to check the validity of some hypotheses, and sometimes the literature happened to be the source of hypotheses that were further tested. Due to its substantial influence on the overall investigation, the process of literature review needs to be transparent too.

Knowledge acquisition constantly reshapes our understanding of reality and affects the way we interact with it. Consequently, the books and other publications that were consulted throughout the investigation can also be considered as biases, since they had an influence on the way the reality was perceived. This is particularly true for *Oppenheimer's acclaimed Bordering Chaos* (Oppenheimer 1996) and the classic *Labyrinth of Solitude* from Paz (Paz 1985), that provide a wide, dense framework for analysing macro political, social and cultural features of Mexico, which was hard to develop in the local case studies. Generally speaking, these books did not bring novel ideas to the investigation. They rather offered a deeper insight into the understanding of factors that were identified throughout the fieldwork. For instance, issues such as corruption, mistrust, or the limited financial capacity of the municipalities repeatedly appeared in the interviews as factors influencing sanitation development. The literature linked these issues to the culture and the political history of Mexico. The comparison and confrontation of different points of view in publications enabled personal statements to be validated and the sources of discrepancies between authors to be understood.

### 2.3. Choice of factors and relationships

Thus, the literature review can be regarded as a bias, which intervenes in the distortion of the first-hand perception of reality. There is another source of bias that is more specific to this research and which regards the choice of factors and relationships that form the boxes and links of the conceptual maps. This phase of the research, where the concepts and relationships deemed most relevant were selected to be part of the map involved some subjectivity. If, at this stage, two researchers were given the same data sets and asked to build their case study map, the final results would probably differ, though the two maps would probably be consistent, as far as their general patterns are concerned. Despite the indisputable bias associated with this selection process, this stage of the research was undertaken methodically and in a transparent manner, so that the coding of all the data collected in each case study can be consulted in the *NVivo* files compiled in the attached CD-ROM.

Another source of bias associated with the design of the maps regards their degree of complexity. Although the three conceptual maps developed in this study can seem complicated enough, the number of concepts and relationships were kept to a minimum. The issue was to find out the right balance between overwhelming complexity and naïve simplicity of the representation. If the number of concept-boxes had been halved, the maps would probably be viewed as too simplistic representations, whereas adding more factors would probably make them too large and detailed. The relationships between the concepts could be far more numerous too. Nonetheless, the optimal complexity of a conceptual map will differ from person to person, and eventually it depends on how the selection process is carried out, and on which concepts and relationships are deemed relevant enough to be incorporated in the map.

## 3. *Relativity*

### 3.1. Regimes of truth

Sanitation development lies at the heart of this research. Development implies the notions of growth and improvement. Growth can be assessed quantitatively but improvement is a much more subjective term, that involves the idea of value, and much caution is required to define clearly what is meant by it. To decide if something is good,



better, bad or worse than something else, a reference point is needed. As far as history can tell us, there has never been a valuation or cultural system common to all the people on earth. Cannibalism can be a respectable custom in one tribe, while the neighbouring people view it as a barbaric practise. The consumption of some foodstuffs is considered unhealthy and inappropriate in certain groups of people, whereas it can be the basis of the diet of people in another region. In *The Labyrinth of Solitude*, Paz (1985) presents the contrast between the ways North American and Mexican people regard health:

‘Like their Puritan ancestors [the ancestors of the North American people], we [the Mexican people] believe that sin and death constitute the ultimate basis of human nature, but with the difference that Puritan identifies purity with health. Therefore he believes in the purifying effects of asceticism, and the consequence are his cult of work for work’s sake, his serious approach of life, and his conviction that the body does not exist or at least cannot lose-or find-itself in another body. Every contact is a contamination. Foreign races, ideas, customs, and bodies carry within the germs of perdition and impurity. Social hygiene complements that of the soul and the body. Mexican, however, both ancient and modern, believe in communion and fiesta: there is no health without contact. Tlazolteotl, the Aztec goddess of filth and fecundity, of earthly and human moods, was also the goddess of steam baths, sexual love and confession. And we have not changed very much, for Catholicism is also communion’ (Paz 1985).

This shows that the definitions of health are multiple, they vary amongst different cultures and can be in contradiction to each other. What are regarded as good, or healthy practises might differ from one region to another. What is perceived as good or bad does not only vary spatially. In *The Genealogy of Morals* the German philosopher Nietzsche (Nietzsche 1967a) examined the question of morals (i.e. the Good, the Bad) and showed its evolution, that is, its inconsistency through time. According to him, knowledge is a question not of true discovery but of the construction of interpretations about the world which are taken to be true (Nietzsche 1967b). French social philosopher Foucault was insightful in showing how questions, madness or sexuality for instance, are analysed and defined differently through space and time, and that power relationships are embedded in these discourses (Foucault 1979). He found out that discourse is discontinuous, marked by historical breaks in understanding, changes in the way objects

are conceptualised and understood (Foucault 1980). Nietzsche and Foucault coincide in that they both reckon that Truth, the Good and the Bad do not exist in absolute. Knowledge is not transcendental or universal. It is specific to particular times and spaces. Foucault talks not of truth *per se*, but of 'regimes of truth' that is, the configurations of knowledge that 'count as truth' under determinate historical conditions (Barker 2000). Truth is relative in space and time, and the power dynamic it implies is illustrated in the clash between scientific and local knowledge of the natural environment (Robbins 2001a).

In the analysis of complex social issues, it is crucial, as Sabine Häusler (1993) demonstrated, to step back and look at the larger picture. In a critical assessment of community forestry, she points out that in the emerging discourse of an environmental crisis, the old colonial soil conservation discourse is revived. Overpopulation, overgrazing, cultivation of too-steep slopes, farmers' ignorance and competitive use of scarce forest resources are the designated causes of environmental degradation and deforestation in the south. The causal relationships framing this approach make sense and seem logical and true. Häusler notices that the initial processes that led to environmental degradation are excluded from this discourse: the introduction of industrial, export-led growth policies, deteriorating terms of trade for Southern countries, currency exchange-rate mechanisms, debt service to the World Bank and other lenders, the role of transnational timber corporations... (Häusler 1993) What Häusler manages to deconstruct critically is that the western scientific analysis of community forestry was embedded in a regime of truth dictated by the power-knowledge relationship of dominance of the North over the South.

### 3.2. What motivates sanitation development?

A critical review of the development of sanitation in western history can lead to a debate about the existence of a sanitation development problem. The second part of the 19<sup>th</sup> century saw the development of the sanitary revolution. The first aim of the sanitation control policies was certainly the eradication of the plagues that had decimated the population. However, the continuous development of sanitary conditions through the 20<sup>th</sup> century through new sanitation technologies, major civil engineering projects, and hygiene regulations can be seen as merely requisites for the on-going

economic development of western societies. Industrialisation is a part of the capitalist race towards increasing profit making. To allow the society to keep on track, generating more and more wealth, the power had to reshape some of its features, notably to improve the workforce productivity. Foucault demonstrated that the control of the sexuality by the State and by the bourgeoisie during the 19<sup>th</sup> century was directed towards a greater productivity of the industry workforce (Foucault 1979). Laws prohibiting the sale of alcohol late at night or early in the morning met the same objective. Recent studies point out that in England, the Victorian state was concerned by the fact that proper water and wastewater management was crucial for Britain's imperial and industrial power (Walvin 1988) and that social reforms were necessary to avert revolutionary uprisings (Timimi 1999). Although these comments can appear obvious or trivial, what is relevant is to see how such motivations permeated a discourse which represented the interest of the powerful. From this perspective, the scientific discoveries of the 19<sup>th</sup> century can be seen as an instrument used by the powers in force, the bourgeoisie and the State, to support a continuous development of sanitary conditions in order to meet their interest, namely work efficiency, economic growth, and political stability.

During the second part of the 20<sup>th</sup> century, sanitation development has been presented by the international community as a means to improve people's health, and a step towards poverty eradication. As such, improving sanitation in the Third World is a challenge, and the state of sanitary conditions in developing countries is considered a problem. However, people in developing countries may perceive sanitation in a very different way. Defecating in the open air was not regarded as a problem by millions of people, before the western experts presented it as such to them. Is lack of development a problem? Are poor sanitary conditions in developing countries really an issue? The Neo-Marxist theories approach development from a capitalist world-system perspective. This view, elaborated by Baran, Frank and Wallerstein, is that the western, dominant, metropolitan areas (the centre) subordinate the Third World satellite areas (the periphery) through military, political, and economic power in order to extract a surplus (Robbins 2001b). This process generates underdevelopment within the satellite areas, and a state of dependency on the metropolitan zones. Improving sanitation in the periphery, from this perspective, is in the interest of foreign capital since it provides



business for firms which manufacture sanitation equipment as well as increase the productivity of the 'cheap' Third World labour force, on which big business, domiciled in the North, depends. This results in a dependent economy and the generation of more benefits to the metropolitan areas. According to the Neo-Marxist point of view, the centre does not only regard the poor sanitary conditions prevailing in the periphery as an economic issue. It is also the manifestation of an alternative way of life, that escapes the capitalist system, and it is in the interest of the metropolitan areas to keep a control of the modes of development through uniformity.

### 3.3. The definition of good sanitation in this study

These ideas are exposed to point out that the notions of good sanitation and sanitation development are not absolute. They differ, spatially, from one culture to another, and in time, within the same culture. Some may regard sanitation development as a means for the capitalist world-system to make people increasingly productive and alienated, but in my view, improving sanitary conditions cannot be essentially detrimental to humankind. Nonetheless, it is necessary here to clarify what is meant by good sanitation in this research, since it often refers to 'better sanitation facilities', 'poor sanitation' and 'improvement of sanitary conditions'.

The point of reference that was used to assess the value of sanitation is mainly based on the current western perception of health. Thus, in my view, a sanitation system is seen as improving if the exposure of users to faecal contamination at the different stages of the process (i.e. excreta collection, disposal, and reuse) is reduced. Sustainability criteria, including environmental impacts of sanitation systems are also taken into account since they affect the population. Additionally, sanitation systems were also evaluated, according to their influence on people's way of thinking. In my view, 'flush and forget' sanitation systems promote a fragmented perception of life since they lead people to view what a few minutes ago was part of themselves as a filthy reject. These systems allow people to disconnect themselves from what they produce, to lose the awareness that they form part of a nutrient cycle. On-site dry (or composting) sanitation systems might not be very practical to use in densely populated areas, but they are very beneficial to the psychological health of humankind, because they keep the people aware of their intimate connection with the processes of life. In this respect, some

sanitation systems can be said to promote a fragmented perception of life, which inevitably leads to more fragmentation and chaos (see Chapter 2 section 4.4.). As Esrey puts it, 'It is not waste that we should dispose of, rather the concept of waste' (Esrey and Andersson 1999). For these reasons, in my view, the shift from ecological toilets to sewer system in San Luis Beltran was not an improvement, though the local population might be less exposed to faecal contamination.

## **4. Critique of the approach**

### **4.1. Causality**

The notion of causality is another important aspect of this study, which is relevant to mention in this discussion on the objective-subjective nature of this research. All the concept-links that form the maps' connections were described as causal relationships. There is indubitably a correlation factor between the related concepts, but are causal links always the best way of representing the reality of these relations? Are they really the result of one another or is it merely the way we want to perceive them?

Philosophers have long debated the controversial idea of cause. Greek philosopher Aristotle (384-322 B.C.) distinguished four types of causes: the material cause (the matter in which all the other causes operate and out of which the thing is constituted), the efficient cause (the external agent that allows the process to get under way), the formal cause (the form into which the thing is changed), and the final cause (the purpose or desired goal for which something is done) (Bohm 1980). Although they became very influenced by this ancient, and yet very complex, conception of causality, medieval thinkers were attracted to the problem of causality long before most of Aristotle's texts became available in the 13<sup>th</sup> century. Already in the 12th century they viewed the universe as a rational manifestation of God (Stanford Encyclopedia of Philosophy 2001). Likewise Budha, who had advised against the search of ultimate causes and beginnings (Goonatilake 1984), Auguste Comte (1788-1857), the French father of positivist thought, held that cause should be excluded from the language of philosophy. According to him, causality was associated with the immature theological and metaphysical scientific assumption of a First cause, God (Comte 1903). Positivism abandoned the quest for absolute explanations and focus on the discovery of laws based

on the observable relations between phenomena. During the 20<sup>th</sup> century, the dismissal of the ‘great-machine’ Cartesian worldview by the new sciences, notably through the discoveries of quantum physics in the realm of the sub-atomic particles, brought a shift in the way of dealing with the notions of predictability and causality. ‘Predictability in science still remains, but within definite boundaries; causality remains, but causality of a peculiar statistical kind’(Goonatilake 1984).

In the context of this research, the use of causal links appears to be a very convenient way to describe most of the relationships amongst the factors influencing sanitation. It is possible, though, that in this holistic process of establishing connections, in the ‘cerebral attempt at recovery of interconnections lost in the course of analysis’(Pieterse 2001), causality appears a too simplistic, too mechanical way of comprehending complex social and cultural situations.

#### 4.2. Combining quantitative and qualitative approaches

The methodology followed for this research principally involved qualitative research techniques. However, it did not exclude quantitative methods of investigation: some sewer and flow measurements, as well as some water quality assessments were undertaken. The description of some factors influencing sanitation and some relationships would have certainly benefited from quantitative analysis. Qualitative methods allow the recognition of the main factors, but their description becomes more valuable if they can be quantified and if the magnitude of their influence can be defined. Social surveys undertaken at a larger scale than those carried out in this study can complement the interviews by putting values and figures in front of issues identified during informal talks with interviewees. Time availability limited the possibility to undertake social surveys on a larger scale to supplement the information collected during the interviews. Nonetheless, the final output of the work, i.e. the conceptual maps would probably gain much accuracy from a greater combination of the so-called ‘hard’ and ‘soft’ approaches.

#### 4.3. Systems approaches

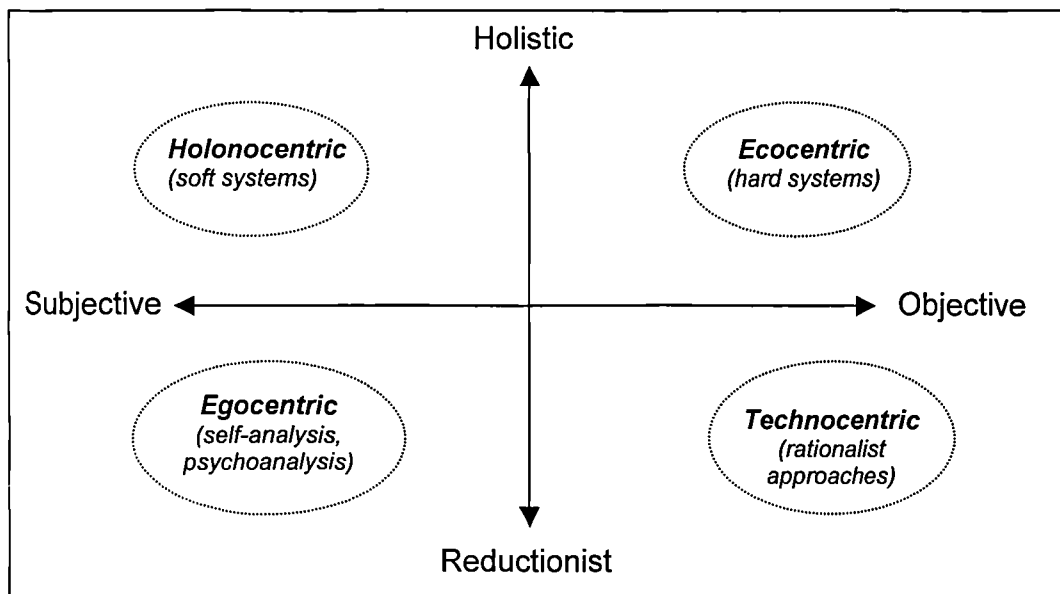
This study is entitled ‘A holistic approach to the assessment of sanitation development in Mexican villages’. During the 90s, the terms ‘holistic approach’, ‘participatory approach’ and ‘integrated management’, became fashionable, notably in the fields of



medical research, natural resources management and development. It is relevant here to look again at the meaning of a holistic approach, and to discuss its advantages and disadvantages. Figure 7.1. shows a diagram developed by Stephens and Hess (1999) to shed light on different types of system approaches. This representation compares research approaches according to two axes of perspective – the degree of reductionism and degree of subjectivity.

A concept fundamental to holism is that the whole is greater than the sum of its parts. Holistic approaches, as opposed to reductionist ones, aim to study the entire system, taking into account the interactions of its sub-systems. The reductionist approach is to break down complex systems into simple constituents, based on the assumption that they can be fully understood in terms of their isolated parts. The horizontal axis of Figure 7.1. characterises the approach according to its degree of subjectivity. A typical objective approach deals solely with facts, the existence and properties of which are deemed independent from the observer. Subjective approaches reckon that the observer interacts with the object of his or her study (i.e. social phenomena).

Figure 7.1. Classification of systems approaches



(Stephens and Hess 1999)

The decision making computer programs WAWTTAR (Finney and Gearheart 1998) and SANEX (Loetscher 1999) can be defined as *ecocentric* approaches, since they take in consideration a huge number of variables describing the sanitation issue. Despite

their clockwork sophistication, these models fail to consider the complexity and the unpredictability of the social and cultural factors and their interactions with the rest of the system. Although these programs can be used effectively as decision making aids for the choice of sanitation technologies, it would be sensible to complement their use with social and cultural assessments.

Sanitation development methods have traditionally had a tendency towards *technocentric*, fragmented approaches, where parts of the system only are considered, ignoring the interactions of the system sub-components. 'End-of-pipe' solutions are symptomatic of that kind of approach. Sewer systems are built without assessing the environmental impacts (i.e. river and groundwater contamination) and the implications of sewer use in terms of water availability. Ecological toilets are offered to the populations without the required education and follow-up phase. Technocentric approaches fail to look at the 'big picture'. They solve parts of the issue but often produce greater disharmonies, pernicious side-effects on other parts of the system.

*Egocentric* approaches do take into account the subjectivity inherent in the problem, but again, fail to embrace the whole issue and focus on one portion of the system only. In the El Mirador case study, for instance, such an approach could lead to the psychoanalysis of the school staff and the members of the school parents committee to investigate the issue of corruption, which was shown to affect parents' participation and resulted in useless cistern toilets.

As shown on Figure 7.1., this investigation was based on a methodology that shares the characteristics of *holonocentric* approaches. It aims to investigate the entire sanitation issue, focusing on factor interactions, under the assumption that the whole is greater than the sum of its components. The qualitative methods that were extensively used in this research take into account the subjectivity inherent in the study of social phenomena. The advantage of such an approach is that it should prevent 'end-of-pipe' solutions, 'palliative patch' measures to be implemented. It excludes a fragmented perception of the issue and promotes interdisciplinary approaches.

#### 4.4. Critique of holism

Systems thinking, as Pieterse puts it, is ‘an attempt to piece together again that which has been taken apart that developed ‘as part of the analysis recovery syndrome’ (Pieterse 2001). Holism is the systemic recombination of fragments in a new totality, but ‘the attributes of the system, however, are unlike the properties of wholeness. [...] Humpty Dumpty put together again is not the same Humpty Dumpty’ (Pieterse 2001). Holistic approaches represent an improvement in relation to the Cartesian analytical thinking, but yet it is short of wholeness.

Vagueness is often cited as a disadvantage of holistic approaches. They propose to investigate everything, ending up with little information on lots of aspects. They often lead to an overwhelmingly complex representation of the problem at the expense of a deep understanding of the parts of the system. In my view, an optimal use of holistic approaches certainly involves finding a balance between the investigation and the comprehension of the overall patterns, and the understanding of the behaviour of the parts.

According to Pieterse (2001), the main weakness of holism is that it has no critical edge and no political economy. Without a critical edge, ‘holism easily becomes totalizing, romantic, soggy. Without holism, criticism easily turns flat, sour’ (Pieterse 2001). The holistic approach to the assessment of sanitation development in Mexican villages would indubitably lead to a much sharper insight into the issue if it addressed in more depth the macro economic and political aspects of development. The comprehension of sanitation development in the three case studies would be far more complete if it were investigated from the larger perspectives of development theories, from a world-system point of view, as briefly suggested in the section 3.2. of this chapter.

### **5. Transferability of the approach**

According to Neuman (1997), field research is virtually impossible to replicate. By this, he probably means that qualitative research is not highly reliable, that is, if two researchers undertake the same investigation, they will not come up with exactly the same observations. Reliability in field research depends on a researcher’s insight, awareness, suspicions, and questions (Neuman 1997). Consequently, the investigation



undertaken in Tepezalá, El Mirador, and San Luis Beltran can be replicated, but the consistency of the results will certainly be considerably lower than that expected in quantitative studies due to the observer bias (c.f. section 2.1.).

Nevertheless, the holistic approach itself can be followed in a wide range of other situations. Theoretically, there is no scale limit to which this holistic approach to sanitation development can be transferred. This study demonstrated that the methodology could be successfully applied to micro-scale research, i.e. the Morelos primary school, and to the investigation of community systems of various sizes (3500 inhabitants in Tepezalá, and about 1000 in San Luis Beltran). In practice, though, it is obvious that working at a much larger scale (towns, cities, catchment or regional level) would pose a number of difficulties. These systems are far more complex than the ones investigated in this study. A team would be necessary to carry out this work, that would probably spread over a larger period of time than the 5-6 months needed to complete each of the three case-studies. The transferability of the methodology requires that the people running the investigation have a sufficient knowledge of the local language(s) and culture(s) to learn as much as possible from the sociocultural environments they study.

## **6. Conclusion**

This chapter demonstrated that the idea of acquiring absolute knowledge and understanding of sanitation development in a Mexican community or anywhere in the world is essentially an illusory quest, a lure. Despite their weaknesses, qualitative methods of investigation combined with a holistic approach represent a relevant attempt to improve the comprehension of such complex issues. The advantage of qualitative approaches resides in the fact that they address the potential sources of subjectivity of the research process and consequently offer the possibility to minimise them. Holistic approaches are valuable as they withdraw the boundaries of academic disciplines, allowing sanitation development to be comprehended as a whole. However, the outcome of holism is not the original wholeness, but rather a recombination of all the parts of a system into a coherent ensemble: causality sometimes appears a too mechanical, Cartesian way of describing the nature of the relationships amongst the parts. Finally, whatever the quality of the data collection process, whatever the

complexity and the accuracy of the conceptual maps developed, the knowledge produced is embedded in a regime of truth and as a result it is not impartial. The approach followed in this investigation would therefore be enhanced by integration of the sanitation issue into a critical macro economic and macro political perspective.

## **Chapter 8 - Applications and Further Research**

### **1. Introduction**

Chapters 6 and 7 demonstrated that the understanding of sanitation development can be enhanced by systems approaches and the use of conceptual maps. Holistic approaches offer a global picture of sanitation development, counterbalancing the trend towards the fragmentation of complex issues into separate disciplines. Conceptual mapping reliably presents the composite picture resulting from the holistic approach, highlighting the diversity and the interconnectedness of the factors influencing sanitary conditions.

Prior discussion indicated that the methodology followed throughout this study could, in theory, be applied to a variety of situations. This chapter discusses the contribution of this research within the field of sanitation and examines the limits of its potential applications for development in general. Avenues of investigation are proposed, that pursue the themes addressed in this research, and that could lead to better strategies for water and wastewater management all around the world.

### **2. Applications**

#### **2.1. Investigation of complex issues**

The holistic approach to the assessment of sanitation development in Mexican villages developed in this study is not site or object specific. It can be used to develop a better understanding of a wide range of complex issues. Water management issues (e.g. water supply, water quality for human consumption or industrial processes, wastewater reuse and soil salinisation) can be better understood using the same methodology. Indeed, a conceptual map was used in a recent report to present the interactions of the different water uses in the management of the Doubs and Saone river basins in France (Syndicat Mixte Saone et Doubs 1998) (c.f. Figure 3.3. in Chapter 3). The organisation responsible for the management of the river basins found out that conceptual maps are useful in communicating the complexity of this task, and can serve as a basis for dialogue among the different water users.

The possible applications of the conceptual map naturally extend beyond the fields of water management. For instance, Jamal Kazi used cognitive maps, a kind of conceptual map, to understand the influences of public participation in forest management in Canada (Kazi 1997). Any problem can be described using such a conceptual framework. Health issues (e.g. hygiene promotion, AIDS), economic issues (e.g. unemployment), or management issues (e.g. conflicts in organisations) are a few examples of the potential fields of application of the methodology followed throughout this research.

## 2.2. Exploration of generic causes

In the attempt to explain a complex problem, such as the lack of sanitation development, there is often a trend towards oversimplifying the problem by identifying a few generic issues, taken as principal causal agents of the problem (c.f. Chapter 2 section 3.1.). The conceptual maps allow a close examination of these causal agents, which are not explicitly defined. For instance, the analysis of the sanitation issue in Mexican villages might lead some people to think that money, or the lack of it, is the main cause of poor sanitary conditions. But designating economic poverty as the main driving factor for sanitation development is simplifying the reality, creating a generic causal agent, a separate entity, responsible for the whole issue.

Conceptual mapping and a holistic approach can show how this type of thinking oversimplifies reality. A systems approach would indeed present lack of money in a community as a manifestation of a lack of financial capital, which is related to its natural resources, and to its social capital. In turn, the notion of social capital refers to 'features of social organisation, such as networks, norms and trust, which facilitate co-ordination and cooperation for mutual benefit' (Putnam 1993). The work of people, their ability to exploit the local natural resources, use their knowledge, work together and exchange products and services can be apparent through the availability of financial resources, including money. Designating economic poverty as the chief reason for low sanitation distorts reality by hiding its complexity. This simplification habit was already identified by the UNDP Sustainable Livelihoods Unit: 'financial thinking tends to focus on financial capital, using economics as the only valid yardstick for measuring success, while ignoring other, even more valuable forms of capital such as social, human and natural capital' (UNDP 1999). The notion of financial capital cannot be dissociated



from the social and cultural mechanisms leading to the production of wealth. Lack of money restricts the capacity of communities, municipalities and states to improve the water and sanitation infrastructure, indeed, but it is essentially the manifestation of a series of social, cultural and political factors.

Conceptual mapping can bring to light what is masked by the simplistic approaches that make use of generic, separate causal agents. In the El Mirador case study, lack of strong leadership, corruption, poor social fabric and the heterogeneous cultural background are such factors that affect the financial resources of the community. The description of the issue through a conceptual map shows that economic poverty is an important issue. It also suggests that injecting funds into this social system might result in the improvement of the school sanitation facilities, but it may as well foster corruption and increase community division.

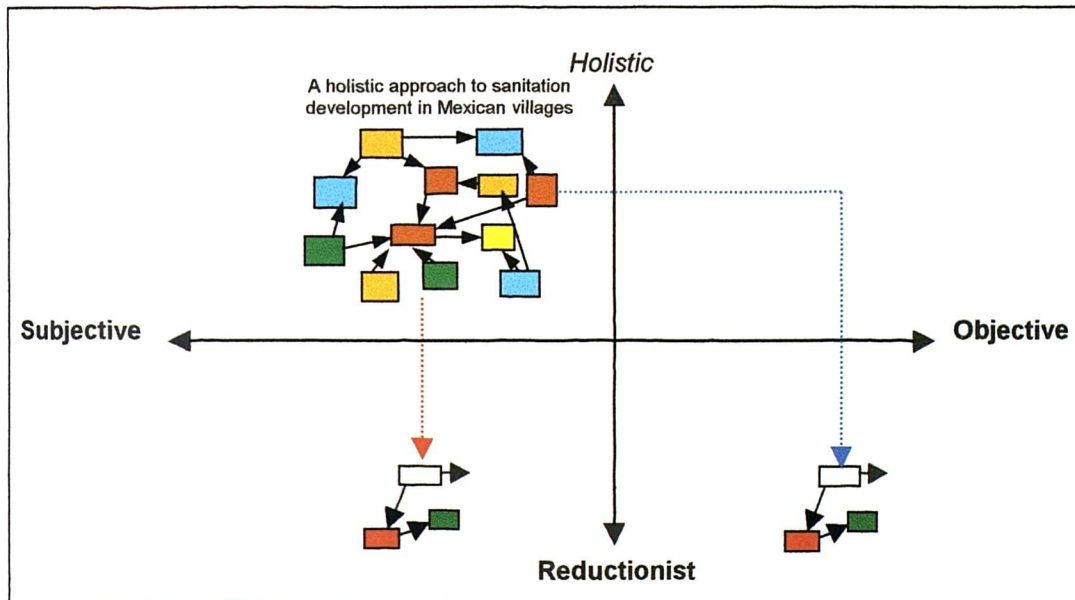
### 2.3. Detailed map analysis for action planning

Thus conceptual maps can be used to extend our understanding of complex problems, by representing them in the form of systems. Then, from a holistic perspective, it is possible to use a conceptual map in a more deterministic way, by fragmenting it in smaller components (this is represented by the red dotted path on Figure 8.1.). Provided these components can be analysed quite independently from the rest, and aware of the interactions of these sub-systems with the whole, they could be used effectively to define appropriate strategies for sanitation development. It is my intention, that the fundamental purpose of the conceptual maps developed in this study, is to improve the understanding of sanitation. No solutions are advised, but they can be derived from the analysis of portions of the maps, with a global view of the problem.

The subjectivity of the results obtained through this methodology can be reduced in several ways (blue dotted path on Figure 8.1.). The number of interviews can be expanded, some sub-issues can be quantified, and the investigation can be carried out as a team, for instance. An interdisciplinary team including local stakeholders could significantly reduce the observer bias. There would still be a bias, that of the group, but it is likely to be less significant than that of an individual observer. Cross-checking among the group members is likely to increase the validity of the final representation, and its objectivity. As the conceptual map is built, the interdisciplinary team can analyse

it in detail, recognising the main weaknesses and strengths of the system, its cycles, and assessing with the stakeholders what the priority measures should focus on. The analytical phase shall could in a list of potential measures that could be implemented at micro, local and regional level. Some actions may need to be implemented simultaneously since they depend on each other. They may also require municipal or state support. The conceptual maps provide the possibility of showing to the decision-makers (e.g. the investors, the government) the expected impact of these measures on the whole system, why they need to be implemented at the same time, and how they can support the project.

Figure 8.1. A holistic approach to sanitation development in Mexican villages



#### 2.4. Interdisciplinary teams

Improving the understanding of complex and crucial issues related to development, such as sanitation concerns a wide range of people and public and private organisations. Governments, consultant groups, NGOs, national and international donor groups all have an interest in elaborating strategies that will make best use of their investments and make them as profitable as possible in the long-term for the beneficiaries. Interdisciplinary approaches have been increasingly praised by most of the organisation involved in development. According to a report by Liebler (1994) for USAID WASH programme, the added values of interdisciplinary teamwork are:

- A holistic, system view of the situation/problem that avoids oversimplification and generalisation

- Reports written so that they can be understood across disciplines and by non-technical managers.
- Strong supportive evidence for taking action
- Integrated solutions and plans that take into account linkages and interactions among the technical, managerial, political, and human elements in the situation.
- New techniques and innovations. (Liebler 1994)

The methodology developed in this study could provide a useful framework for such interdisciplinary teams. A group of specialists, experts in a wide range of disciplines, as well as project stakeholders is likely to maximise the benefits derived from this holistic approach. The participation of experts would allow a detailed investigation of some parts of the system, reducing the vagueness of the representation, a general reproach to holistic approaches. Interdisciplinary teamwork is more consuming in time and resources, but provided these are available, the development of the conceptual maps can be an interactive, learning process for all the participants, leading to a better understanding of the issue for each team member.

In addition to the direct project-oriented applications of conceptual mapping, it is worth emphasising that this kind of holistic approach potentially has fundamental, underlying effects on the people who undertake it. In my view, sitting as a group around a table, interacting and discussing the concept-boxes and their mutual links can encourage people to think more holistically. They can communicate using a simple language (that of the concept boxes), excluding too technical a vocabulary. This would allow more interactions because language is often a singular barrier to the exchange of ideas across disciplines. This is essential since, as outlined in Chapter 2 section 4., fragmentation of knowledge and its segmentation in rather hermetic disciplines, resulting in a narrowed approach of complex issues, has caused ill-development and failed to solve the increasingly chaotic water and sanitation context in developing countries.

Interdisciplinarity and the use of holistic approaches are attractive and represent a breakthrough in the endeavour to comprehend the world in a more unified way. Interdisciplinary studies are 'an attempt to transcend the narrow confines of the particular present disciplines that grew out of the historical process in the West' (Goonatilake 1984). However, as discussed in chapter 7, section 4.4., holistic

approaches have got their shortcomings, and generally fail to recreate wholeness. Similarly, 'interdisciplinary research is more widely applauded than it is practised' (Pieterse 2001). It often merely involves the combination of, rather than the interaction of disciplines. Goonatilake (1984) stresses that these disciplines are unable to comprehend the problems occurring in a non-Western reality. He argues that consequently, interdisciplinary studies 'can at the most provide additional glimpses of physical reality but not major breakthroughs or structured knowledge' (Goonatilake 1984). This alludes to the previously discussed notion (c.f. chapter 7, section 3.1.) that knowledge is relative, embedded in regimes of truth. Whatever the approach, deterministic or holistic, narrow or interdisciplinary, the understanding it creates remains partial and dependent on a power-knowledge structure (that of the West, as far as development in the Third World is concerned).

### **3. Further research**

#### **3.1. Implementation**

The conceptual maps developed in this study are the product of academic research and were developed by a single person. Arguably, they represent a useful means of representing the complexity of sanitation development. In my view, they should be the products of investigations undertaken by interdisciplinary teams and then be used as a tool for launching community or regional projects. It is likely that the practicability of the approach, its strengths and weaknesses would become apparent when applied, and the methodology could consequently be refined.

A piece of farm machinery, like an ox-plough, may be designed in a University and tested on a plot, producing valuable results. However, despite all its attractive properties 'on paper', as reflected by promising statistics, the appropriateness of the plough can only be tested through its implementation by farmers outside the academic environment. Likewise, the holistic approach to the assessment of sanitation development needs to be tested in real conditions. Universities, NGOs, governments and other national and international organisation can test it, but until the achievements of projects developed with this methodology are assessed, it is hardly possible to evaluate the suitability and the relevance of the approach. This assessment can be a topic of research.



Most of the impediments to the proper use of the approach developed in this research are likely to stem from a resistance to think holistically, a difficulty to abandon the routine mechanism of fragmentation. While some organisations might adapt easily to this kind of interdisciplinary work, many will probably remain stuck in their traditional mode of operation: fragmenting the issue into different compartments that are tackled by separate groups of people, according to their educational background. This is likely to be the case in municipal and state governments that tend to function in a very bureaucratic way. The analysis of these obstacles represents a very interesting theme of investigation.

As pointed out in section 1.1, the holistic approach developed in this research can be applied to a number of complex issues. This investigation focused on sanitation in Mexican villages, but the essence of this study is the methodology, and its application shall not remain confined to water management and sanitation.

### 3.2. Scenario planning

As mentioned in Chapter 6 section 4.2, the conceptual maps are, to a certain extent, comparable to snapshots that depict the current state of the system. They can give a feel of how the system may evolve, but predicting the future lies beyond their properties. The conceptual maps developed in this study can serve as a basis to understand a complex issue holistically and are a valuable tool for building interdisciplinary strategies, but they can hardly anticipate significant political, economic or social changes in the system.

What is needed thus, is to combine the approach developed in this study with a tool that can help to predict changes in the system. Scenario planning was introduced in corporate planning in the 1970s by the Shell Company. 'Forecasting is generally 'obvious' or 'wrong'. And even most multiple forecasts turn out to be inadequate in retrospect. However, future thinking is the key to long term prosperity and to maintaining and improving a company's competitiveness and wealth creating ability' (Royal Dutch - Shell Group of Companies 2001). The group could foresee the likelihood that the long period of stable oil prices may be disrupted. During the first petrol crisis in 1973, Shell was much better prepared than its competitors to respond.

In the case of San Luis Beltran, for instance, scenario planning would mean imagining possible futures that could affect the sustainability of sanitation development options. Climate change, population growth and their likely impacts on water availability for the community could be a limiting factor for the use of the sewer system. At the opposite, the construction of a regional wastewater treatment plant in Oaxaca City could encourage the sewer system network extension option. By reflecting on diverse possible futures, the organisations can begin the process of preparing for them. It reduces the risk of being caught unawares. Thus, by integrating scenario planning to the holistic approach presented in this study, organisations could develop a sharp understanding of a complex issue and plan their actions considering the possible changes of the physical, political, economic and social environment. There is a need to investigate how these two tools could be combined and implemented.

#### **4. Conclusion**

The development of conceptual maps as a result of a holistic approach finds numerous applications beyond the fields of natural resources management, water supply and sanitation development. In my view, this type of approach is particularly relevant to people or organisations willing to explore complex issues through several dimensions (e.g. technical, social, physical, historical) and unsatisfied with simplistic explanations involving a set of separate causal agents. Conceptual maps provide a means to lay on one sheet of paper a complex description of the issue investigated. Arguably, it can also be used as a basis, or at least as a good tool, in the decision-making process of a project. In the case of a sanitation development project in one of the three communities studied, conceptual maps can be analysed in detail to determine the focus actions of the projects. Although it does not represent a way to obtain any absolute, impartial form of knowledge, it seems to me that the approach developed in this study is valuable and represents a step forward in the way of understanding sanitation development. Nevertheless, the actual practicability and usefulness of this approach remains to be tested on a real project. Preferably this should be done by an interdisciplinary team, which would be more likely, in my view, to value this type of approach, and identify all its strengths and weaknesses.

## Chapter 9 - Conclusion

### ***1. Formulating the 'holistic approach'***

This research started with the assumption that the fragmented perception of sanitation development could be a major cause of the international community's failure to improve the sanitary conditions of a larger percentage of the world population. In other words, the working hypothesis was that the failure to consider the interconnectedness of the various components of sanitation development was partly responsible for the actual state of sanitation in the world.

The aim of this work was to improve the understanding of sanitation development by presenting the issue as a whole, that is to say without fragmenting it into several independent aspects. It was assumed that such a shift in the perception of sanitation development could lead to more successful and sustainable strategies. As a result, a holistic approach to the assessment of sanitation development was designed. A pilot case study permitted to improve the understanding of the research arena. It led to the selection of a set of data collection techniques appropriate to assess sanitation development as a system. Although the methodology allowed detailed information about the system components to be gathered, it prioritised the study of their interactions. The approach was then tested on three Mexican communities. The analysis of the data collected focused on the relationships between the factors influencing sanitation development. This resulted, for each case study, in the creation of a conceptual map representing the sanitation development system.

### ***2. Research findings***

#### ***2.1. Breaking up disciplinary boundaries***

The holistic approach developed in this research appeared to be very appropriate to the study of sanitation development as a system. The methodology, largely based on the application of qualitative methods of research, allowed sanitation development to be studied as a whole and to launch specific inquiries into this broad field of investigation. It allowed the study to develop without the constraints imposed by the boundaries of academic disciplines.

Thus, the holistic approach, which was set up in Mexico and tested on three case studies represents a successful attempt to counterbalance the fragmented perception of sanitation development. It is nonetheless essential to recognise that holism does not recreate wholeness, the original picture. The product of a holistic approach is merely the recombination of all the parts of a system into a coherent ensemble.

Conceptual mapping appears to be a convenient means of representing sanitation development as a system. The conceptual maps were found particularly useful to highlight the diversity and the interconnectedness of the factors influencing sanitation development. The web-like representation of the system provides a means to overcome the habit of breaking up a complex issue into distinct and separate disciplines. The use of sub-maps allows a detailed examination of the content of the overall maps without losing sight of the 'big picture'.

## 2.2. Limitations of the conceptual maps

Despite their versatility and relevance to the holistic assessment of sanitation development, the conceptual maps developed in this study display some limitations. The relationships among the system components are exclusively causal, and sometimes causality appears a too mechanical, Cartesian way of describing the complexity of living systems. Other weaknesses of the conceptual maps stem from their flat, two-dimensional nature, which tends to freeze spatially the representation of the issue and could lead to misinterpretations by novices. The conceptual maps developed in this study do not weight the factors and their mutual relationships. A quantitative assessment of the system components, generating an extra dimension to the maps, could make them more accessible to readers. The downside of weighing the system components however, would be an increase in the subjectivity of the approach.

## 2.3. Research transparency and the quest for objectivity

Transparency at all stages of the research process (data collection, data analysis and presentation of the results) is a major strength of the approach developed in this study. The techniques of qualitative research used address the potential sources of subjectivity and allow a critical assessment of sanitation development. This research demonstrated that the idea of acquiring absolute knowledge and understanding of sanitation development in a Mexican community or anywhere in the world is essentially an



illusion. Whatever the quality of the data collection process, whatever the complexity and the accuracy of the conceptual maps, the knowledge produced is not impartial because it is embedded in a regime of truth. A deeper insight into sanitation development in Mexican communities can be gained by investigating it further from critical macro-economic and macro-politic perspectives.

### **3. Research applications**

Testing the holistic approach on three case studies was primarily undertaken to assess the validity of the methodology in varying circumstances. The by-product of this repetition of ‘experiments’ is a good understanding of the state of sanitation development in Mexican rural and peri-urban zones. Some patterns common to several case studies appeared to be characteristic features of Mexico. As a consequence, this research has the potential to generate some interest amongst the people and organisations involved in water supply and sanitation development in Mexico. In addition to promoting a global insight into sanitation development, this study can make these stakeholders more aware of some key impediments (political, cultural, institutional, etc.) to the sustainability of sanitation projects.

The applications of this research extend far beyond the fields of natural resources management, water supply and sanitation development. The holistic approach developed in this study is relevant to all the people and organisations wishing to explore and understand complex issues in an integrated way. Conceptual maps offer the advantage of laying on one sheet of paper a snapshot of the complex issue investigated. Arguably, this approach can be used as a key tool in the decision-making process of a project. By offering a comprehensive assessment and a global picture of a complex issue, the holistic approach developed in this study can significantly contribute to the design of strategies, by identifying the existing constraints and opportunities.

Using this holistic approach with conceptual mapping in the context of *multidisciplinary* teams is the assurance that the work will be undertaken in an *interdisciplinary* way. Indeed, the concept-boxes of the maps need to be concise, stand-alone, and accessible for all. Provided all the members of the team participate in the mapping phase, this

holistic approach offers a framework which may encourage the specialists to interact more with each other and become more aware of the risks of a fragmented approach.

#### ***4. Suggestions for further research***

Although the approach developed throughout this research can find applications as an educational tool to promote integrated and interdisciplinary approaches, it has the potential to play a significant part in the decision-making process of real life projects. To confirm its versatility and validity, the holistic approach to the assessment of sanitation development needs to be tested on real projects. This work should ideally be undertaken by an interdisciplinary team, which would be more likely, in my view, to value this type of approach and identify all its strengths and weaknesses. There is certainly much to learn about the application of this type of approach by public and private organisations in the context of a real project, regardless of the nature of this project.

The aim of this research was not to develop a decision-making tool. However, from this perspective, the holistic approach developed in this study has a deficiency: a conceptual map shows the current situation of the system and its recent changes but fails to make prediction about its future evolution. A good decision-making tool, though, must be able to envisage different scenarios so that strategies taking into consideration the likely changes of the system can be set up.

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Overall, the research only validated the working hypothesis to a limited extent. It demonstrated the weaknesses of fragmented approaches, which are constrained by their disciplinary boundaries and lead to a limited understanding of sanitation development. Indeed, the holistic approach developed in this study reveals how significant the interactions between factors traditionally associated with distinct disciplines are. As such, the outcome of this research strongly suggests that interdisciplinary teamwork, notably through the use of holistic approach, would make development projects more sustainable. However, until holistic approaches, such as the one developed in this study, are applied to a number of sanitation projects, it will be hard to conclude that the

fragmented perception of sanitation development is a major cause of the current state of sanitation worldwide.

Although the working hypothesis was only validated to a limited extent, the work undertaken permitted to achieve the two objectives set at the beginning of this research:

- . A holistic approach to the assessment of sanitation development was developed. As part of this approach, conceptual maps were used to represent sanitation development as a system, and
- . The application of this approach on three case studies demonstrated its relevance to the investigation of sanitation development as a system, focusing on the diversity and interconnectedness of the system components.

Despite some weaknesses, the conceptual maps crystallise one of the key messages of this research: knowledge fragmentation and the creation of an increasing number of academic disciplines has resulted in a more accurate understanding of the parts of Life. Unfortunately, most people have lost the awareness that this fragmentation process is a man-made tool, and the trend is now to view the world as made of separate things that can be dealt with independently through distinct disciplines. The conceptual maps plainly show how interdependent these disciplines are, and how interaction is necessary among the specialists tackling these issues, if strategies that bring harmony to the whole system are wanted.

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# Appendices

## 1. Research process

### 1.1. Case study selection

The research aim and objectives being defined, the investigation started in El Copal, the pilot case study, where a large array of data collection techniques was tested. At that point, however I did not know the names and locations of the three communities that would be investigated next. Each new site was actually chosen one after the other as the investigation unfolded. This flexible attitude with respect to the research design permitted me to make the most of attractive opportunities. This section provides extra information on the case study selection process and on the characteristics of the sites chosen. The process is described in a chronological order and the emphasis is put on the actual way things happened, including the people that I met, and my feelings, which influenced the choice of each case study.

#### a) El Copal

This PhD research project was undertaken as part of the Alpha Red Agro Latino Program, funded by the European Community. It was a result of the co-operation between Cranfield University and the Institute of Agricultural Sciences (ICA.) of the University of Guanajuato.

In June 1999, ICA was engaged in a project involving the construction of an off-site WWT system (the combination of an Imhoff tank and a constructed wetland) in El Copal, the community hosting ICA. Three years after its inception, the project was still in its construction phase, as difficulties kept arising, delaying the operational phase. In addition, the municipality had built a sewer system that was not operational yet two years after its construction. This was a striking example of a sanitation system that had hardly improved despite a very favourable economic and technologic background. El Copal was appropriate for a pilot case study. It is a small community. The situation of its sanitation system was intriguing. The aim of the research indeed built up through the observation of this interesting situation. The local academic environment provided me substantial support and guidance, which were much needed during this pilot phase.

b) Tepezalá

Once the pilot case study was completed and the methodology was established, I started to look for the location of the first case study. I mainly relied on two electronic databases of the National Water Commission (CNA 1997)(which provided information about the municipal WWT systems listed per state and per municipality), as well as a national road map, to start selecting the communities. One of the database files showed that Aguascalientes State had promoted the use of stabilisation ponds in a great number of its localities. I decided to focus on this off-site WWT technology, widely used in the central and northern part of the country.

I planned a small tour to Aguascalientes to explore some potential sites for the research. Tepezalá was the first location I visited. I introduced the investigation to the mayor in the town hall. He expressed much interest in the study and organised a visit to the head of the municipality on the next day. Tepezalá seemed a relevant place for a case study. The sanitation infrastructure appeared to be complex: on the one hand the majority of the dwellings were connected to a sewer system that discharged in a very rudimentary stabilisation pond, whose effluent is used for crop irrigation. On the other hand, a part of the population still uses very basic pit latrines or defecates in the open air. The relative proximity of the University of Guanajuato (about 150km) was reassuring, since I thought that my methodology could require some more adjustment, and I felt that I might still need guidance and support from the academic staff of the University of Guanajuato.

c) El Mirador

Tepezalá and El Copal are both located in central Mexico and share many characteristics. Their physical, cultural, and economic environments are comparable. After Tepezalá case study, it seemed essential to me to make the most of the extraordinary cultural and natural diversity Mexico offers. I chose to undertake the next case study in the south of the country. After several meetings with NGO members in Mexico City and other informants, I decided to follow the investigation in the central part of Oaxaca State. In Oaxaca City, people from the CIIDIR (Investigation Centre for the Integral Regional Development) expressed interest in my research and recommended me to check the relevance of El Mirador community to my investigation.

As expected, the natural and sociocultural environments of El Mirador differ a lot from those of El Copal and Tepezalá. Yet, El Mirador presents the characteristics of a widespread phenomenon of most developing countries: *an explosive population growth* due to massive rural exodus and urbanisation. El Mirador is a 15-year-old, fast growing community of the peri-urban zone of Oaxaca City, inhabited by a heterogeneous population of poor immigrants. Unlike the previous case studies where the whole community represented the boundary of the system investigated, the work in El Mirador focused on the sanitation system of the community primary school. A short visit to the school revealed its miserable sanitary conditions. I found that it was a great opportunity to test the sanitation system evaluation approach at a reduced scale.

#### d) San Luis Beltran

The choice of San Luis Beltran as the final case study was easier. I had decided to undertake the last part of the fieldwork in a community that had participated in a development project involving the use of on-site sanitation systems. El Copal and Tepezalá relied mainly on off-site sanitation systems, and El Mirador had not yet chosen any specific sanitation strategy. During an earlier meeting in Mexico City, Enrique Vignau, a NGO leader had told me about San Luis Beltran, a small village that had pioneered the use of dry ecological toilets in the country. As this community met all my selection criteria, I chose it to be the last case study.

In the early 1990s, San Luis Beltran had definitely rejected the ‘flush and forget’ sewer system approach and adopted successfully the dry ecological toilet technology. However, ten years later, the same people hold antagonist and rather unexpected positions, as they supported the construction of a sewer system. I felt it was relevant to the study to try to understand globally this apparent incoherence in the development of sanitation.

### 1.2. Fieldwork procedure

This section presents the unfolding of the fieldwork. It describes the various steps of a procedure that was consistently followed for each of the three case studies.



a) Establishing first contacts

. *Meeting the local authorities*

The first thing to do after selecting a community was to ensure that the local authorities agreed with having a researcher investigating and carrying out interviews in their village for several months. I did not know anybody in Tepezalá, in El Mirador nor in San Luis Beltran before starting the investigation. The first few days spent in each of these three communities were crucial. It was essential to respect the social organisation of the community, so I had to talk with the leader first. He was the one who could authorise the investigation to begin. In Tepezalá, the municipal president was the first person I met in the village. In El Mirador, the director of the school was my first contact. The election of the community leader had occurred only one week before my arrival and thus I met both the ex-community leader and the new one a few days after the start of the investigation. As for San Luis Beltran, the municipal agent was the first person I contacted.

. *Finding key informants*

Being authorised to carry out the investigation, I needed to find key informants. In the very early stages of the investigation, it was useful to meet informal leaders who had a good knowledge of the community and many acquaintances. These people, who were often good informants themselves, were able to direct me to key informants.

In Tepezalá, the assistant director of the local DIF (Integral Family Development) office introduced himself to me on the day I arrived. He helped me to find accommodation in the village and presented me to several key informants. In El Mirador, the key informants were found among the teachers. The school director advised me to interview the official in charge of the supervision of the primary schools of the area. This person was a very valuable informant, who gave me a rich description of his insight into the difficulties of the local schools. In San Luis Beltran, my first key informant was the owner of the ecological toilet workshop. We had a friend in common and this helped us to establish a good relationship. In turn, he was able to direct me to other potentially relevant informants: ex-municipal agents, water supply and sewer committee members, the ejidal committee president, and various dwellers.

. *Introducing the research*

Most of the people that I met during the course of the fieldwork expressed some interest in knowing about the nature of the research, and they also enquired about the institution I was working for. It was necessary for me to introduce my work in a way that would not jeopardise my chances of interacting freely with the people. First of all, I had to make it clear that my research was not carried out for the Mexican government, and that I was not linked to any political organisation, which the people sometimes feared, in this historically tense pre-election context. In addition, I often excluded technical expressions such as 'holistic approach' or 'integrated water supply and sanitation management' from my vocabulary, since they would merely put some distance between my informants and me. Hence I usually presented the study as an analysis of the sanitation system, comprising the identification of the various barriers preventing its improvement. Alternatively, I also explained to the people that I was trying to understand how their sanitation system had evolved, or why it had not improved.

The people and especially the local authorities were very concerned about the likely benefits the community would receive from my work. I always tried to be clear about the fact that my investigation was not forming part of a project directly benefiting to the community. I nonetheless mentioned that my work could be profitable for the community, by increasing people's awareness and by submitting a report on the situation to the authorities at the end of the fieldwork.

b) *Baseline study*

The first few weeks of each case study were spent acquiring knowledge of the local natural, historical, cultural and socio-economic environments. The community was also examined in its regional context. This stage was a prerequisite to launching more specific inquiries in the community. At this stage, I also started to gather information about the water supply and sanitation systems. Institutional and political issues had to be examined early too, such as how the community is governed and who is in charge of the water supply and sanitation issues?

This baseline study was undertaken through direct observation, literature review and interviewing. The statistical reports from INEGI provided a good information basis to describe the natural environment (topography, geology, hydrology, land use) and the

socio-economic background (demography, people's activities) locally and regionally. Interviews of community dwellers or state and municipal officials provided more details and updated information relevant to this baseline study.

c) Focusing on major issues

When sufficient information had been gathered to give a first global picture of the community and its environment, specific issues could be investigated more carefully. I examined in more detail the ideas that had come out during the first weeks of the case study. This part of the investigation was undertaken mainly through interviewing and surveying. For instance, in the case of Tepezalá, some semi-structured (topical) interviews were used to explore the wastewater treatment strategies carried out by the state authorities in small communities. Some information about the existing operating WWT systems, notably that of Tepezalá, had previously been gathered during the baseline study. Similarly, in San Luis Beltran, the impact of the state ecological toilets program on the village was investigated. When I interviewed the owner of the ecological toilets community workshop, I already knew much about this program, and I was able to explore in depth how the corrupt attitude of the government affected the involvement of the community in the ecological toilet technology.

The procedure that was followed implied that a global picture of the situation had to be developed during the first stages of the case study. Yet, the second phase, involving focus on specific issues, was not completely separate from the baseline study. Information about the local and regional environment was continuously collected throughout each case study. Similarly, some concepts were examined in detail during the baseline study because they were richly and spontaneously described during conversations. It would have been counter productive to interrupt the interviewee and tell him or her: 'Let us not discuss the issue more in detail for now, since I am doing the baseline study now'!

### 1.3. Qualitative interviewing: practical aspects

a) Choosing interviewees

The research involved the investigation of a large number of social, technical and political issues. The topical arena was wide and embraced a great variety of interviewees including community members, farmers, politicians, civil engineers,

hydrologists, primary school teachers, researchers, doctors, and members of national and international institutions and non governmental organisations. The choice of the interviewees varied according to the scope of the inquiry. In the early stages of a case study, the interviewees deemed to have a global perception of the situation were sought. As the investigation progressed, it focused on more specific issues and the interviewees were chosen in this respect. For instance, the director of the World Bank in Mexico was a key informant to obtain a global perspective on politics and water management at the national level. Engineers from the National Water Commission in Oaxaca City and from the municipal water operator organisms were well qualified to provide a detailed picture of the critical water supply and sanitation situation regionally. Members of the water committee of San Luis Beltran were ideal interviewees to tackle local water management issues. Similarly, the ex-community leader of El Mirador was interviewed about the division in the community.

Generally speaking, the people selected were very amenable to being interviewed. Mexican people are generally very hospitable and usually enjoy the company of foreign people, notably when they are European. This facilitated the first contact with most interviewees. The people I met were mostly helpful and often directed me to other potential interviewees. Indeed, there was no interview planning established at the beginning of the case studies. It all unfolded quite spontaneously and most of the other interviewees were chosen as new ideas came out.

#### b) Interview setting

The location and time of the interviews were generally fixed by the interviewees. In all cases, except in a few specific circumstances, the interviews took place on site, that is to say where the interviewee lived (i.e. in the case of community members) or worked (i.e. in the case of politicians, engineers, researcher, members of organisations, pupils, teachers...). It was necessary to establish a relationship of trust with the interviewee. This involved presenting the aim of the investigation and let the interview decide what issues should be kept confidential. Thus, it was fundamental that the interviews took place in private enough privacy. The interview setting was usually chosen so that it offered enough privacy.



In the case of the primary school Morelos, it was more convenient for the teachers to be interviewed at school. However, I had to interview them separately, as some conflicts and pressures were evident among them. It was arranged that each teacher would be interviewed in his/her own classroom, during the recreation time or at the end of the day. With one teacher, a second interview was organised in the city to explore in more depth some sensitive issues. Similarly, after a few conversations in his office at school, the school director accepted to be interviewed at his home in order to address sensitive topics involving the misbehaviour of some teachers.

The time of the interviews was usually set according to the availability of the interviewee. In the communities, it was generally very easy to interview the women, as most of them stayed at home with their children during the day. Community members were usually very hospitable during the weekend, though Saturday mornings were not appropriate for interviewing, due to men's tendency to heavy drinking at the weekend. The politicians, engineers and members of organisations usually set the time of their interviews. Despite this, some flexibility was required because 'ahorita', in Mexican, can either mean 'right now', 'later in the day', or 'tomorrow'... Having a car allowed me to minimise some disappointments when dealing with the unforeseen and the occasional lack of punctuality of interviewees.

#### c) Recording and transcripts

The data collected through interviewing were either partly memorised and recorded as field notes, or taped using a microcassette recorder. How the information was recorded depended on the context of the interview and on the interviewee. In Tepezalá and in El Mirador case studies, the community members usually appeared reluctant to the use of the microcassette recorder. In San Luis Beltran, however, the inhabitants were more confident and several interviews were taped. Usually, the community leaders, the government officials and people from private organisations were not incommoded by the use of the microcassette recorder.

It was essential to transcript each interview on the day it was effectuated or early on the next day, especially in the case of written notes records, to be able to add up all the relevant information freshly stored in memory. Consequently, there were seldom more than two interviews realised on the same day. The interviews were transcribed on MS-

Word file format and the interviewee's sentences were quoted as often as possible. A log section was inserted at the beginning of each transcript. It informs the reader about the context of the interview (date and time, setting, general feeling, personal comments) and specifies the part(s) of the interview that were deliberately left away. The log section brings transparency into the data collection process and makes the information livelier for the reader.

#### 1.4. Social surveys: practical aspects

##### a) Setting and recording

People were usually surveyed where they lived, except in El Mirador case study, where the pupils were interviewed in a quiet place of the recreation area during the lectures. It was essential to develop an atmosphere propitious to the free expression of the interviewee. The surveys were usually conducted after several weeks of visits and qualitative interviews in the communities, and consequently the inhabitants were less suspicious. The survey answers were recorded as field notes. Usually no more than four persons were surveyed per day, and the data collected were generally transcribed on MS-Word files before the end of the day.

##### b) Population samples

In a social survey, the population sample has to reflect the characteristics of the targeted group. Gender, age, socio-economic level, dwelling location, are such criteria that can affect the perception of water and sanitation issues and that were taken into account in the sampling of the population. However, the surveys undertaken were not designed to yield statistically valid results, and the sample size and characteristics were not defined in that perspective.

In a typical survey, the individuality of the interviewee and the uniqueness of his/her perception are usually neglected. Generally, the same questionnaire applies to everybody. This approach can be appropriate when the surveyed persons all belong to the same cultural arena, that is, when each question has exactly the same meaning for each interviewee. The two surveys carried out in Tepezalá were undertaken on culturally homogeneous samples of population. However, in San Luis Beltran, part of the population recently settled in the village, and they don't share the culture of the

native people. Some questions had to be phrased differently to take into account this cultural gap.

## **2. Data collection techniques: examples**

### **2.1. Informal conversation with a primary school teacher, El Mirador**

Conversation with Anabel, teacher of 1<sup>st</sup> grade A, 21/06/00

Log:

Transcript: from notes and memory

Setting: In her classroom after school

Feeling: she was quite on a hurry at the beginning but she rapidly took time to express her ideas and feelings through long sentences.

Comments: She expressed herself fast and clearly, linking all the sentences with rare necessity to get my feed back. At some point, I decided to interrupt the conversation and to continue it later on, because the interview was getting long, the sub-director was outside and I felt he could suspect that we were dealing with hot issues concerning him. She agreed and she said it would be better if we could meet two days later in Oaxaca City.

Left away: introduction of my investigation in Mexico and in the particular school case study.

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J: According to you, what are the reasons that can explain the state of sanitary conditions at school, and more generally, the bad state of the school infrastructure?

A: 'There is a great apathy from the people to improve their conditions of life in general. In addition there are political groups in the community that fight for the power, this also prevents the school from improving. [...] as when there are persons from the two factions in the committee (parents' association committee)...'

J: But in the current parents' committee, which political party do the members belong to?

A: 'I don't know in which party they are but I got aware that it has much to do with that. The others [the parents of the pupils] do not support [the committee]. There is something else, what a shame...in the previous committees, the treasurers took the money with them. [And so the people say:] Why am I going to co-operate if this man is going to take the money? But this is not the only reason, there are many causes [to the state of inertia of the school]. Another reason is the extreme poverty in which the people live. This hinders their co-operation. Those who co-operate are people from the residential zone and people who are aware. As for most of the other people, it is necessary to take their money by force.'

J: And what do you feel about the toilets?

A: 'This became a big problem last year: the pit filled up. Apart from the bad odours, during the rainy season we feared the latrines would collapse. They made another pit, but they made it so badly that after one rainy night [...] the pit filled up with water. It remained there out of operation. I'd tell you that I don't go there [don't use these latrines]! [The teachers] We called the parents and told them that it cannot go on like this. They do not consider the committee, [so we said] we were not going to work. There is a need to put on pressure' You know how it is in Mexico, people need pressure to work.

J: So the parents do not really consider the importance of this issue?

A: 'No, they do not take it seriously. We told them: go to the toilets [even for two seconds only], take a look, get in there...[...] [But the men said] there is nothing to be feared, there is no risk, they said we are creating a problem that does not exist. The only thing we achieved was to get the parents emptying the pit.'

J: So only those from the residential zone complain?

A: 'Yes, the saddest thing is that these people from the residential zone are leaving [taking their children off the school]...I was happy at the beginning because I thought that the school would improve with them, we would push things...'

J: So how long have you been here?



A: About three years and a half, 'In 1997, there were more people from the residential zone, they left because two or three of them are not enough [to make things change]. Unity of the people is required. The problem stems from the people of El Mirador' They should not expect the people from the other communities to solve their problems. 'I think things will hardly get done. Another thing is that people expect everything from the government, like they have been used to, the paternalism [...] they expect that the government should give the school and maintain it. The government gives a part and the community has to give a part. The (new) classroom has not been finished because some haven't contributed.'

J: Do you mean that the government did enough?

A: 'No, this does not mean the government achieved his duty. The school was initially built for a small population of the community.' I already told the director that 'it is nonsense to create more pupil groups if we do not have the infrastructure. Where are we gonna put them? In other classrooms made of metal sheets?'

J: I am going to tell you about my perception of the dynamic of the school here. I feel that the people send their children here, as they settle in the community or because they are not interested about the education of their children. Then, after a few years, the parents who are worried for their children either send them to other schools or they try to participate more in the school. What do you feel about that?

A: Yes, this is true, this is about the way things are going. Another point is that 'people come from other regions and when they see the situation, the people say: Why am I going to give (money to the school) if the other do not co-operate' They reason with 'envy, but it is justifiable'. I told them: 'we are going to clean and paint this furniture we bought at start of the year and that looks bad after one year, so that the next will have good material to work'. And the people asked: 'why are we going to do that for the others'?

J: There is another issue I would like to deal with you, which is more conflictive. I have learned from some parents that if they leave the school Morelos, it is not only because of the bad infrastructures, it has much to do also with the level of education. They know that some teachers do not work well, do not teach properly. Some parents told me good

comments about you and another teacher but many of them added that they'll take their children off the school as soon as they reach the grade of these male teachers.

A: Yes. 'Understand that this is actually one of the reasons why parents that could contribute to the school leave the school. [...] I think you will have realised who they are [the 'bad' teachers]. This problem is so complex...People get aware of it...It is something we cannot fight against. There is a teacher union that supports the teachers who are fired from schools because they drink, [because they have a hangover], because they don't work. It helps them, it prevents them to lose their work so that they can keep teaching.'

'Besides all the things that you tell me...I can tell you that last year, [I asked the parents] why they did not want to participate. We could go altogether to get support in the City. The director doesn't have the authority nor the energy. [The directors, in their task,] they have to improve the school, they need to go with the committee to go and keep and going again' to demand support from the authorities.

'I got tired from this school... 'I'm going', I said, 'let it go' and then I thought I'd better stay and help the people try to improve' but I mean 'When you find yourself with so many obstacles... I have felt completely disillusioned ...One thing is to get on well among the teachers, another thing is that we have to work'. The director is not fair because 'when we [the female teachers] ask him a permission to leave the school for a moment, he gets annoyed or he accepts.' But the male teachers, 'they don't ask, they get drunk or have hangovers [...] they leave, they are outside [the school during class hours]. It is a disaster with the children in the classroom. They don't work...' The director 'is always very nice and friendly, he says he talked to them [the male teachers], he pretends that he warned them' but they keep with the same behaviours. 'Then I did not want to create any conflict, [I felt that] they were annoyed...'

## 2.2. Topical interview with the mother of a pupil, El Mirador

Conversation with Maxima Morales, Residential Zone Aguayo, 19/06/00

Log:

Transcript: from notes, the questions do not respect my exact phrasing but permits to give fluidity to the reading of the interview.

Setting: in her house with her youngest son (3 years old)

Feeling: very relaxed, very trustful atmosphere

Comments: I explained her that the quality of the education could be related to the improvement of the school in general and of sanitation in particular, that is the reason why I was interested to know her feeling about this issue. After the interview we talked about the division in the community and she reckoned that people come from everywhere, which is not favourable to the unity of the community. People do not want to take part to *tequio* (mutual help work) and so on. Maxima, like all the persons I interviewed so far, preferred that I take notes rather than I use audio recording.

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I explained Maxima that I wanted to know her feeling about the school and so on, but that I had just a few questions to ask her before. I asked her the number of children she had in that school, how long she had been living here, and why she chose this school.

She replied that she had 2 children at school, that they had been living here for 4-5 years and that they chose the school for its *proximity*.

J: What worried you in Morelos school? What do you feel about it?

M: 'The toilets are always dirty, the children have to do the cleaning, there is no water. Every new committee says they will do something...they grab the money! We co-operate. Allegedly the municipality was to put some money and we the other part...'

J: Are you satisfied with the level of education?

M: 'No, I am not satisfied with the teaching either.[...] 'That of the strike: [the teachers were on strike for several weeks] and they left the children without any homework. It can't be like that: 'they go to school, they come back, they're never given homework. We understand that of the strike, but really, how is it going to be possible that they do not give homework to the children? Everyday I review their homework'. But most of the time, the teacher just tell them they can read a page in their book, but this is not homework, they need to write done things and work...'The teachers say: you have to

help us' but they do not give any homework. 'This school, when compared to others, is behind [in terms of education level].'

J: Yes, I see, I mean, myself I've noticed that sometimes children are studying hard in one classrooms, while some other classrooms are empty and the children are playing outside. I was also confirmed this by some of the staff...

M: 'Yes, that is was I tell you! There is no class, it is really incredible, they just do a single task in one hour. Considering this aspect, they are going low. Concerning the sanitary conditions, [the toilets and so on, the teachers cannot do much,] but well, with respect to their own duty, they can.'

J: And what about the parents' committee?

M: 'In the meetings, the parents do not co-operate because they say that they do not see enthusiasm [from the staff].'

J: Why do so many parents do not participate to these meetings?

M: 'The ones who don't come, it is because they are not interested in the education of their children: they send them [to school] without dressing them, without washing them, without [even a tea in the stomach]...Many are very irresponsible with their children. Other say that there is no motivation, they loose their spirit. Many took their children out of that school.'

J: In which school do they send their children then?

M: 'There are several schools around there [...] that are somewhat better considering the infrastructure and the teaching. Many complain about the level of education, it is that the teachers are not really involved.'

J: Actually, yes I was kind of thinking about that and I have to say that I really feel the director is a good person, but he lacks authority.'

M: Yes, that is it, 'they drive him...he is motivated but he lacks, how did you say?...yes,... he lacks authority, that is it...he lets himself being led...they impose themselves to him.'

J: Do your children use the latrines at school?



M: Yes, they don't like it but sometimes 'they use the toilets of the school, of necessity'. They say that it is really dirty and smells bad and that 'in the classroom aside the latrines they cannot work anymore. The [new] toilets were built very badly. We contribute but they do not do the thing properly.'

J: Did you complain about that?

M: Yes, 'the men that went [to look at the toilets] said they are badly built. They say they are going to demand, to see the one who built them.'

J: I've heard of some people from the previous associations of parents stealing some money from the association, is that something true?

M: 'Yes, this is clear that they took it, the money of the association. Already the last time, the shopkeeper of the corner over there [the ex-treasurer of the parents' committee] took \$2000. Similarly, in the current committee, the treasurer borrowed money [and did not pay it back]. They do what they want here.' We gave \$160 for the construction of the classroom, they wanted us to pay \$300. 'Some of us could pay, but some could not', so they said \$200 and 'finally they ended up asking \$160.'

J: How do you see the future?

M: 'The future...I see it very bad!...Well, how old is this school?...at least I predict no improvement...I wish the director, the parents' committee, and each of us could have more enthusiasm...'

### 2.3. Cultural interview of a very old dweller of San Luis Beltran

Conversation with Manuel Acevado Luria, 26/10/00

Log:

Transcript: from mini cassette audio recorder

Setting: at his home, in the garden, under a tree, 3:30pm

Feeling: very relaxed, he was apparently happy to talk about his past, and I enjoyed listening to him

Comments: The man is 97 years old, he is still very lucid and present.

Left away: introduction of my work

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M: 'I happened to be here during the foundation of this agency [politico-legal feature of the community]. We used to work the land with a pair of oxen and a small pike fixed on a wooden stake, to line the soil surface. This was the way we made the soil produce. And these days were very favourable for the humanity because everything was coming well, it was raining a lot, and the harvests were abundant, there was little people.'

J: 'How many people were there?'

M: There was...you see Oaxaca City, well it was like a small village, and it grew up little by little. [...] (*Mentioning God making life easy at that time, somewhat confuse to understand*) It was raining from April to October, so there was a lot of water in the hill, and we never lacked water. When the crops needed water, people would just divert the river to irrigate...and the people were very few. But now, the Mexican territory is full of people and sooner or later people will not have places where to farm. So, with the abundance of people, and the decrease of rainy seasons, we're experiencing the worst calamity. With the population growing and growing, well, there is not enough space for everybody.[...] [*He repeats the same idea*]

J: 'And was the distance to the city greater in the past?'

M: 'Yes, it was taking us like an hour to reach the small town, walking. There were no cars, there was nothing.'

J: 'How many people lived in San Luis Beltran?'

M: 'About 50 or 60 including everybody. And now we have a lot of industries, resulting in the same population movements. And it does not cost much effort anymore to go to the city or to other places because the government has been struggling to help the nation. They have built new roads, they are improving things, and civilisation improves, and [...] [*I can't understand*], before, we used to sleep on the floor lying on our carpet, but not anymore because the people is awakening, people are improving their lives, but the food is getting scarce.' [...]

‘And the movement [*he maybe means the evolution*] of the toilet infrastructures, the place where one goes to discharge one’s body weight [the faeces], we used to call it the ‘excusados’ (the excuses) and now it is the ‘baños’ (the toilets). The toilets are improving, like ours. In order to avoid soil contamination, we have this latrine (*ecological toilet*) with two chambers to store the ....’

J: ‘the shit?’

M: ‘No...’

J: ‘the excrement?’

M: ‘No...the liquid...’

J: ‘the urine?’

M: ‘No..., the fertiliser, and a year after, if the family is big, then the chamber fills up, one empties the other chamber and discharges it to the field, because it has already...already...lost the odour, and has become almost like soil. One discharges it in the field and mixes it with the soil, and the harvest is very good because it is mixed with the soil.’

J: ‘So it works well?’

M: ‘Yes’

J: ‘And there was no such thing in the past?’

M: ‘No, one was doing it [defecating] in the field, because the people were very few...’

J: ‘And when did you get this ecological toilet?’

M: ‘about 10... 20 years ago.’

J: ‘And it keeps working well?’

M: ‘Yes, it does keep on working well, but now the government is building the sewer system...’

J: ‘And do you think the sewer is a good thing?’

M: 'No, because as the sewer runs along the river, and contaminates these wells that they do to supply water to the houses. And this thing (the ecological toilet) that we already have is better because it produces pure soil that is useful for the soil, it helps the soil and gives a good harvest.'

J: 'And it doesn't consume water...'

M: 'No it doesn't, while the sewer necessarily consumes water.'

J: 'So it is a problem...'

M: 'yes...'

J: 'But who wanted to install the sewer?'

M: 'The government did.'

J: 'The people here did not want it?'

M: 'No, the government requires the sewer systems to improve its services, but as far as I'm concerned, I say that it contaminates the streams, the water. Before there was no contamination, because it was clean, the toilets of the people were the fields, when one was going to work or look after the herd, because there was a lot of land. One was taking more care of water.' [...]

J: 'And what did you have here before this latrine (ecological toilet)?'

M: 'Well, as I tell you, simply in the fields'

J: 'And did they build it with the support of the government, or what?'

M: 'No, well, some were lucky and they were helped, others had to make it with their own efforts...the people...to make a better living. [...] Now it is getting populated from the city towards here, because it is a very old settlement here...My parents that died, I asked them how life was. 'The same as now' they said, but maybe it is improving, and this is the way it is, things improve, the life of abundance.'

J: 'But, water becomes scarcer everyday...and water is life.'

M: 'Yes...[...] with Donaji village, the water is distributed to us by the government, this village takes the water from 6am. They have it during all the day. We go up there to cut



it in the afternoon at 5pm, so we have these small tanks to store water for domestic use...so they catch water during the day, we catch it during the night, this is the way it is.'

J: 'The water comes from up there?'

M: 'It comes from the hill, and where it springs, there is no people, so that the water is clean.'

J: 'And when was the potable water network built?'

M: ' In the 60s, but it started in 1940, with the pipe, then they built the distribution boxes, for the houses, to supply water to the population, the government came to install these boxes.'

J: 'But there is not as much water in the hill than before...'

M: 'Oh, no, as I told you as the population grows, as the people multiplies, the water gets scarcer during the rainy season, it is changing.'

J: 'Are there still people farming here?'

M: 'Half of them'

J: 'But the young, do they also work in the fields?'

M: 'No, they work in firms and in the government, we're now only a few to cultivate the fields.'

J: 'And how many ejidatarios are there?'

M: 'There aren't anymore'

J: 'There is no ejido?'

M: 'No, there is just the name. All have got their propriety [titles] now, from the government. It was all sold, there are no more communal lands apart from the hills.'

#### 2.4. Survey of the farmers reusing the oxidation pond effluent, Tepezalá

Name: ..... Age:.....

### Farming Practices:

1. How many years have you been cultivating the parcel?
2. How many years have you been irrigating with the pond effluent?
3. Is there a person willing to cultivate the parcel when you will stop? How do you see the future of the parcel?
4. What is the total surface you cultivate?
5. What is the surface you irrigate: which crops / yields / use (auto consumption, sells)?
6. What is the rain-fed surface you work: which crops / yields / use (auto consumption, sells)?
7. What is your annual planning in terms of crop rotation cycle, periods of irrigation?
8. Do you use fertilisers (nature, quantity, and cost)?
9. Do you use herbicides (nature, quantity, and cost)?
10. Do you use pesticides (nature, quantity, and cost)?
11. What seeds do you use (nature, quantity, cost)?
12. What technique (level of mechanisation) do you use for tillage?
13. What technique do you use for your treatments (sowing, fertiliser application...)?
14. What technique (level of mechanisation) do you use for harvesting?
15. How many people work with you (full time, part-time)?
16. Is there good cooperation among the farmers, for which task?
17. Would more cooperation be profitable for all, how, if not, why?
18. What evolutions did you observe in your farming practices?
19. Did you notice an evolution of the soil fertility and the yields obtained?

### Water Management:

20. Have you got access to the pond effluent for irrigation, if not why?
21. Do you possess a basin to store water, what advantages does it confer?
22. Do you think there are water losses, where and how can they be reduced?
23. What is your opinion on water quality and on the quantity available?
24. What is your irrigation technique, what are its advantages and disadvantages?
25. Do you experience difficulties in irrigation (e.g. water distribution in the field)?
26. Do you use the pond sludge to enrich your soil? If not, why?
27. Do you practice drainage?
28. Could another farmer benefit from this water, why?

### *Organisation and co-operation:*

29. What is your opinion on the operation of water discharge, how could it be improved?
30. Do some benefit more than others, how?
31. What is your opinion on the current organisation (turn time / crop requirements), how could it be improved?
32. Is there cooperation among the farmers regarding water management?

33. Would more cooperation be profitable for all, how, if not, why?  
 34. Did you notice any evolution in the operation of water and in the organisation among users?

**Valuation of the benefit:**

35. What are the advantages and disadvantages of using this resource?  
 36. Which are the risks associated with wastewater reuse, what are their nature and importance?  
 37. What is the opinion of the people in general regarding wastewater reuse?  
 38. How could you benefit more from this resource?  
 39. What is the future of wastewater reuse, here in Tepezalà and in general?

**Potential Scenario: The WWT system is upgraded:**

1. The drainage system is extended: all the houses of Tepezalà get connected and the discharge in the WWT system increases by 20%.  
  
 2. The pond is emptied, the cap of sludge is removed, the pond is excavated deeper and a cap of clay is compacted on the wetted surface (reducing water losses through leakage). The outlet is laid higher and remains open so that only the upper (cleanest) fraction of water leaves continually the pond.  
  
 3. Another pond or constructed wetland is added and receives the anaerobic pond effluent. It also operates continually so that there is permanently water leaving the system. An earthen basin is built close to the parcels of Anastasio, Esteban and Socoro. Thus they can store water and the continuity of water supply is no more a problem.

**As a result:**

1. The water quality is largely improved:  
     A wider range of crops (with more added value) can be cultivated  
     The working conditions are safer and more comfortable  
  
 2. More water is available  
     Larger surfaces can be irrigated, or  
     Some new beneficiaries can use the water  
  
 40. How do you evaluate such a scenario, all right / good / very good?  
 41. What is most important for you, water quality or water quantity, why?  
 42. What would you change in your farming practices?  
 43. Provided water losses can still be reduced adjusting the canals, would you be ready to do that work with the other water users?  
 44. Would you be ready to share the water with a new user, why and on which conditions?  
 45. Apart from you and the other users, who will benefit from this upgrading?  
 46. How do you think the population of Tepezalà is concerned by the WWT efficiency?  
 47. How do you think the public authority of Tepezalà is concerned by the WWT efficiency?  
 48. The quality of the water depends on the well maintenance of the WWT system. The maintenance represents little work/time/skills but needs to be carried out regularly.

Would you be ready to be in charge of it with the other water users, on which conditions?

49. Who should be responsible for its maintenance? Why?

50. Do you think it would be reliable to let the public authorities carry it out, why?

51. Would they maintain it through the years and change of governments, why?

## 2.5. Survey in Cholula<sup>2</sup>, a marginalised sub-group of the population, Tepezalá

Name:

Address:

Number of persons living in the dwelling:

Number of children (under 15) living in the dwelling:

### 1. *WS&S conditions*

#### 1.1. Water supply/ consumption

a) Do you have tap water?

*If yes: discontinuous (max. period of unavailability) /continuous*

*If not: what source(s)?*

b) Do some persons of your family have periodic/chronic diarrhoea?

*If yes: how many? And what is the cause of it?*

c) Which water do you use for drinking?

d) What is the first thing you do when preparing lettuce or tomatoes?

#### 1.2. Sanitation at home

a) Do you have toilets in your dwelling?

*If yes: which kind? (type of receptacle/ structure)*

*If no: where do you defecate? (distinguish among sex/age groups)*

b) Where do you discharge your black water? Your grey water?

c) How do you regard your conditions of sanitation? *Very bad/Bad/Regular/Good/Very good*

d) What is more important to get at home: clean toilets or electricity?

e) What is more important to get at home: clean toilets or electricity?

f) How much money would you save per week for all your family to have access to clean and practical toilet?

#### 1.3. Off-site treatment

a) Do you know about the oxidation pond? *If no, give explanation*

b) Do you think it needs to be improved? Why?

c) What do you think about crops irrigated with the water from the pond?

d) Would you buy vegetables irrigated with the effluent if it was a better WWT system? Why?



## 2. Evolution

### 2.1. Inertia

- a) How long have you been living in this house?
- b) Have your conditions of sanitation improved during the last years?
  - *If yes: How? If not: Why?*
- c) How could your sanitation conditions change/improve?
- d) Do you hope something about that? What? Do you still hope things will change?
- e) Did you ever think about building a latrine and a septic pit in your garden?
  - If yes: what happened?*
  - If no: why not?*
- f) Is it up to you to make things change? Why? *If not: who else?*

### 2.2. Preferences

- a) Do you have some preference regarding sanitation alternatives? Is sewer system what you prefer?
- b) Would you be ready to accept modern latrines (with liquid separation and twin pits) in your dwelling instead of waiting for the sewer system?

## 3. Organisation and communication with the authorities

- a) Have you ever complained to the authorities about your conditions of sanitation?
  - If yes: how long ago, how many times, why did nothing change?*
  - If no: why not? Is it annoying for you to complain about that?*
- b) Have you ever talked with your neighbours about this problem you all experience?
  - If yes: how long ago, how many times?*
  - If no: why not?*
- c) Who represents you (as a leader) to express your requirements? Is he efficient?
- d) Would you be ready to be part of a group to complain to the authorities and try to find a solution (not exclusively drainage system) to your common problem?

## 2.6. Survey of the pupils of Morelos primary school, El Mirador

Hello, what is your name?  
What is your grade?, how old are you?  
Where do you live?

How many years have you been going to this school?

*The answer could lead to further questions like*

How was your previous school?  
Why did you change?  
Where did you live before?...

What is your feeling about the school, what could be done to improve it?

What do you prefer in your school?

What do you dislike the most? What annoys you the most?

What do you think about these toilets?

How is your toilet at home? Is it better?

Do your parents come to the parents meetings? Why not?

Do you think the others school around (Mineria, Soledad...) are better?

How is your teacher? Does he/her teach well, better than the previous one?

## 2.7. Survey of the community dwellers of San Luis Beltran

Legend:

- [The information into bracket is collected through direct observation]
- *The questions in italic are facultative*
- The other questions are compulsory

### *Identification*

Name

[Age & Gender]

[Street & number]

Are you native from San Luis Beltran?

Dwelling structure

How many people live in the dwelling?

[Apparent signs of material wealth (type of house, car, clothes, ...)]

## 1. City lifestyle

1.1. How do you regard the changes in the village, becoming part of the city?

*a) What do you like in the city that you don't have here?*

1.2. What do you like/dislike in the village?

## 2. Water supply

2.1. How would you describe the situation regarding water here?

*a) What is your water source*

*b) Do you have enough water for all the domestic uses?*

*c) Do you have to spare it, to take care of it?*

*d) Do you reuse the grey water?*

2.2. Are you afraid that some day water will lack here?

*a) For what reasons may the water lack one day?*

*b) How will you do then? Buy water? Spare it?*

## 3. Sewer system, kind of toilet, water discharge

3.1. Is the sewer system going to be an improvement?

3.2. Do you have a toilet, what kind?

*a) When did you get your ecological toilet built?*

3.3. Do you think there will be enough water for the sewer and for the other domestic uses?

*a) Are you going to connect a cistern toilet to the sewer?*

*b) Are you also going to discharge the grey water to the sewer?*

*c) Will you keep using the ecological toilet?*

## 4. Evaluation of the ecological toilets (only if existing!)

4.1. Are you satisfied with the way it works?

4.2. What are the advantages, the disadvantages of it?

*a) Is the distance separating the toilet from the house an issue for you?*

*b) Is it also the opinion of all the members of the family?*

## 5. Appropriate use of the ecological toilets

5.1. Can everybody use it properly?

*a) How many people use it?*

*b) Do the children know how to use it properly?*

5.2. What do you cover the faeces with? or What do you throw in the deposit?

*a) Why don't you throw the 3 elements soil-ashes-lime?*

*b) Can you afford the lime?...*

5.3. How often do you have to empty a deposit?

*a) Do you use the compost as fertiliser?*

*b) Does the compost look ok? Is it satisfying?*

## 6. Ecological toilets & social status

6.1. Do you think that the kind of toilet that one uses is related to the economic situation?

6.2. In which conditions would you recommend the use of ecological toilets?

6.3. Do you think that rich people can also want to use ecological toilets?

6.4. Did you know that people of high incomes from Mexico, Europe, or USA use ecological toilets inside their house, in rural and urban zones?

6.5. Do you have an idea about their motivation?

6.6. What is your opinion regarding this choice?

## 2.8. Event account: the parents' meeting at Morelos primary school, El Mirador

Reunion of the parents in school Morelos, 15/06/00

Log:

Transcript: from notes and memory

Setting: in one classroom (56 people using the twenty years old furniture designed for primary school kids)

Feeling: people were very attentive

Comments: the reunion started almost an hour late, I saw a teacher sleeping during the reunion, they were not all present and the director of the association of parents came late because he accompanied the 6<sup>th</sup> grade pupils at the medical visit.

Duration: about 1.5 hours

56 parents present at the meeting out of a total number of 122. The majority is not reached, and as a result no agreements will be taken, the meeting will only be informative. (just 6 persons missing to get 50% +1). The director say 'the one who never come are the one who most complain, they are the one who complain: 'when did you take that agreement?''

Frequency: according to 2 fathers, there are 2-3 reunions/year

Issues:



The new classroom: still need to collect funds to pay the windows

The directors says the municipality representatives do not fill their promises

He thanks and congratulates the work of a mother who got in charge for the management of the construction of this new room.

He mentions the irresponsibility of the parents who did not pay their share

He reminds that many people did not fulfil their tequio. Their names are on a list and the staff will not forget about them.

The list of the people who still haven't paid their share yet was read. There were ??? people listed. The debts ranged from \$10 to \$300 with an estimated mean of about \$120.

The director justified the strike of the teachers of all the states of Mexico during the last weeks. He referred to the article 3 of the constitution that states that the gratuity of school is a right. He explained that the authorities want to 'municipalise' the school. Some mentioned that they could be privatised, given to the rich. The government even suggested that the schools (in other words, the parents) should pay the electricity bills.

The director reminded that 'the government closed the doors to us and even the municipal president came to visit the school, he proposed that we organise in turns: half of the children would come in the morning and the other half in the afternoon.' This is to avoid spending more money for building new rooms. The teachers would be paid the same.

The director recalled that some villages more isolated have got their own school with good infrastructures. Around the El Mirador, three new schools were recently built. He recalled the teachers did not go on strike to increase their salary, but mainly to get social benefits for all the people.

He asked the parents to be more responsible and to help the teachers in the education by making the children do their homework.

He reminded that '40-45% of the children go to school without anything in the stomach. The government is not well aware of this. They say the children do not learn well. How can you learn with such hunger and misery.'

He observed that instead of spending such a crazy amount of money in all this noisy elections they could spend a little more for the children and education.

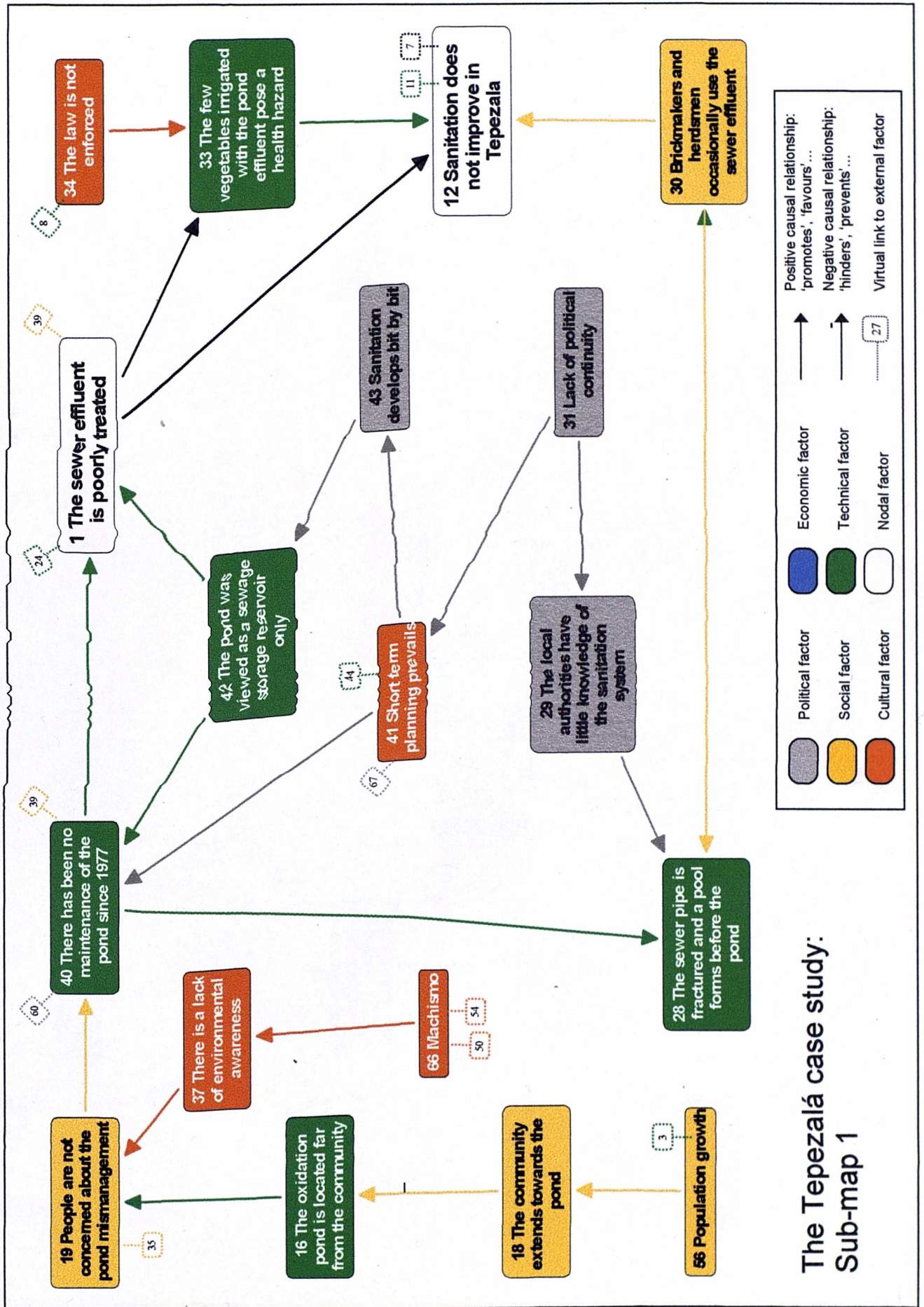
He mentioned the achievements of the strike:

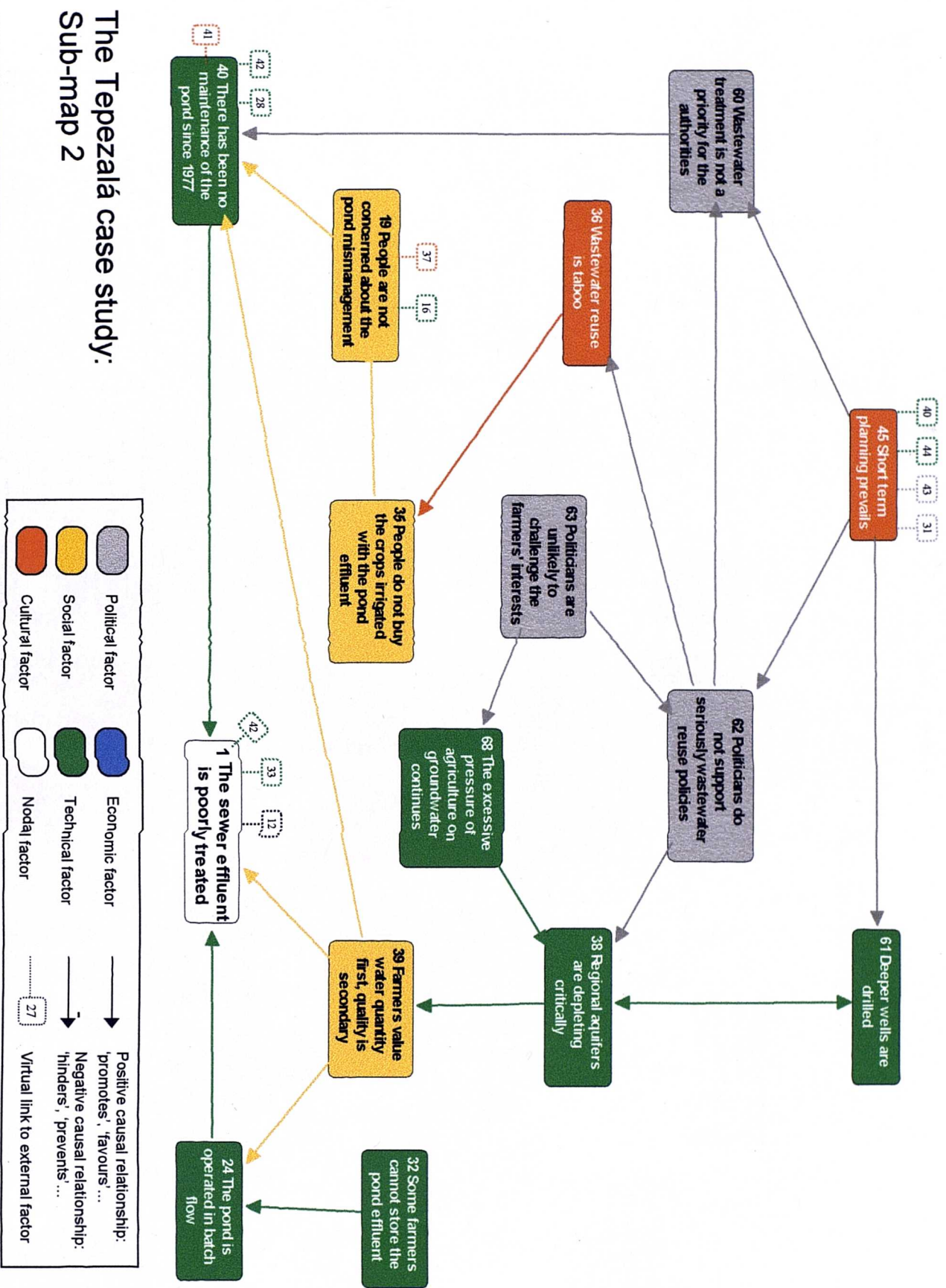
Books free for the secondary schools

The books are the property of the children

The IEEPO will keep on paying the water and electricity bills

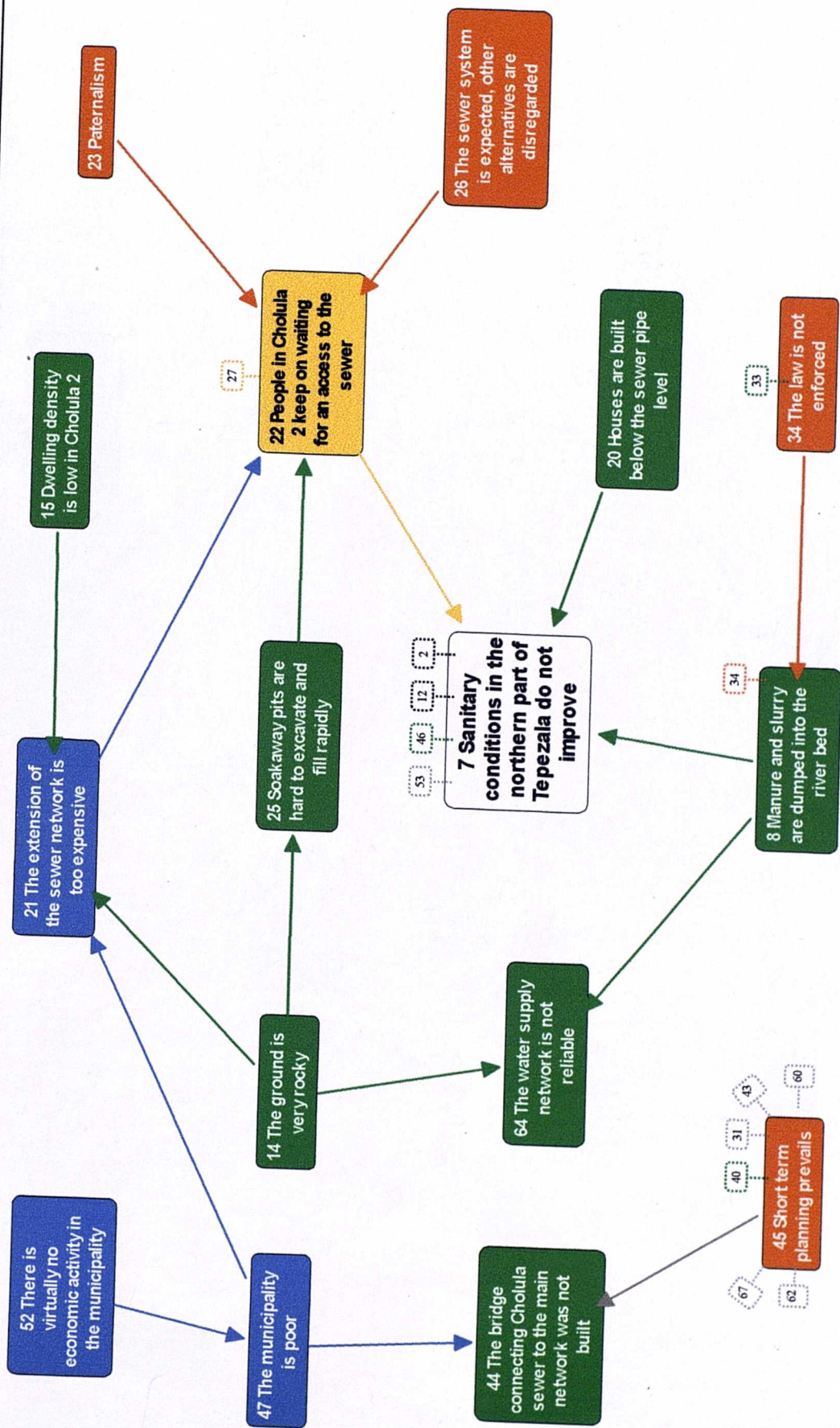
He talked about some people suggesting that the school will change its status (several grades would be taught by the same teacher). This does not sound acceptable for the director considering the proximity of the city. El Mirador cannot be compared to the isolated communities of the mountains.



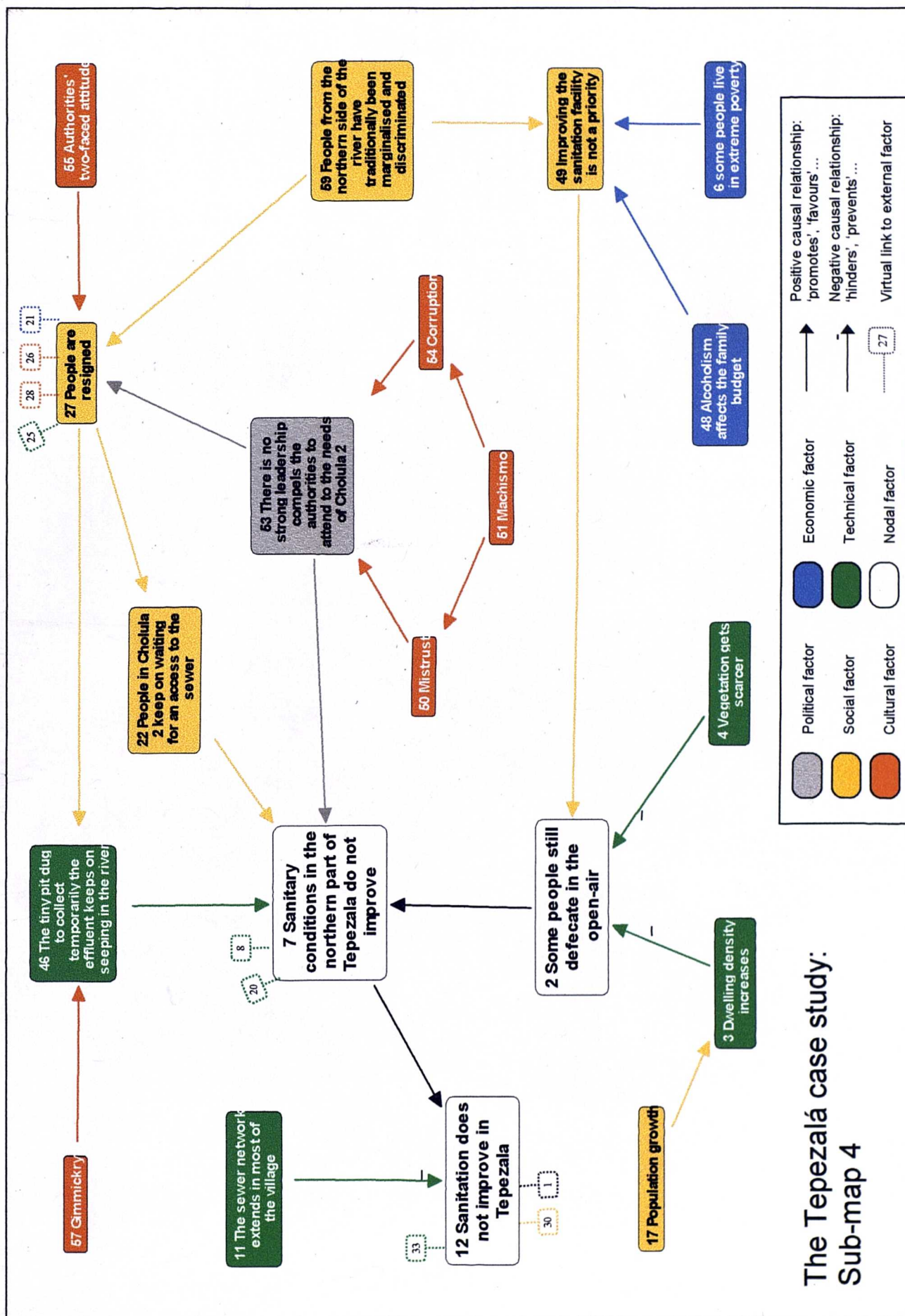


The Tepezalá case study:  
Sub-map 2



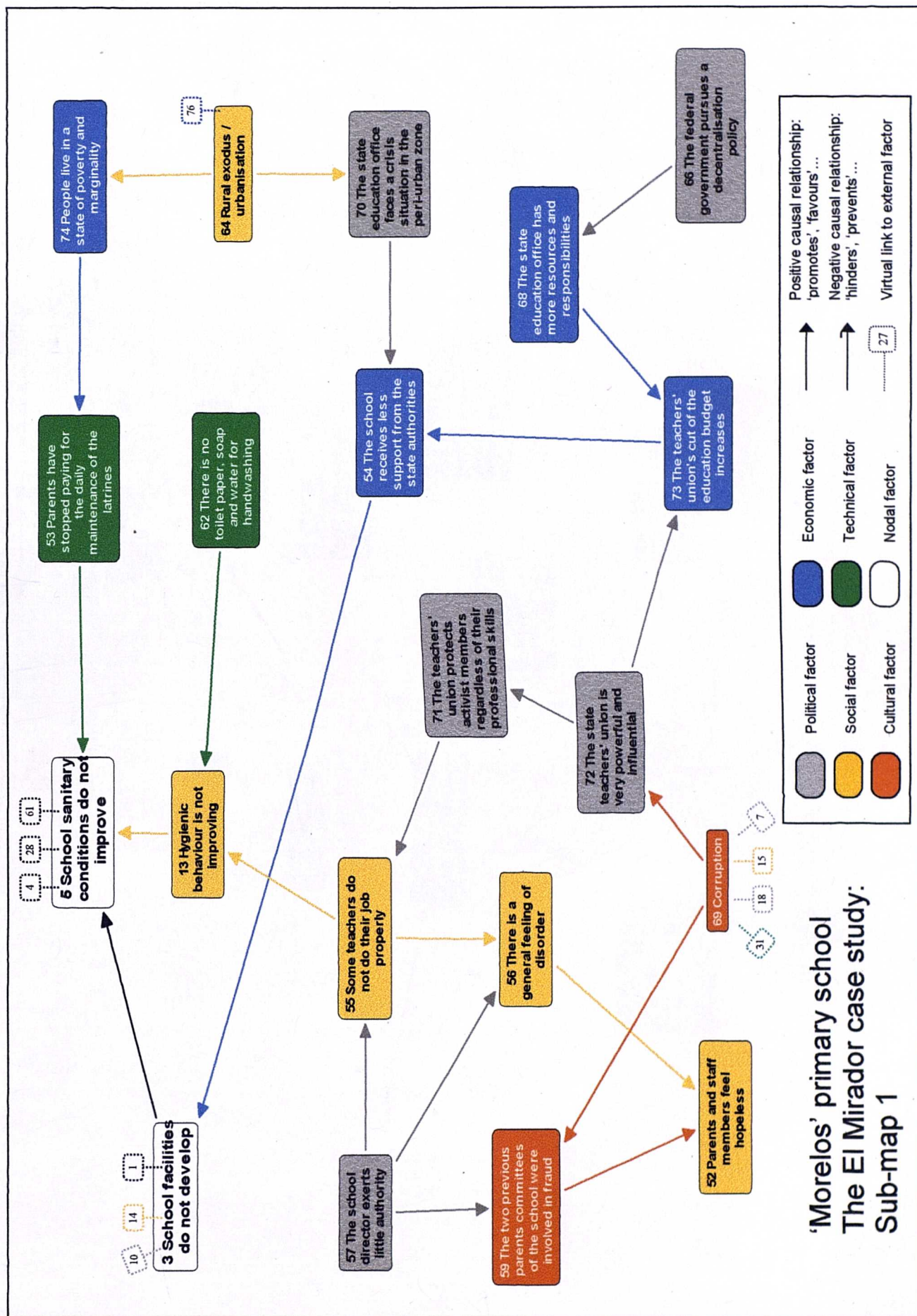


The Tepezalá case study:  
Sub-map 3



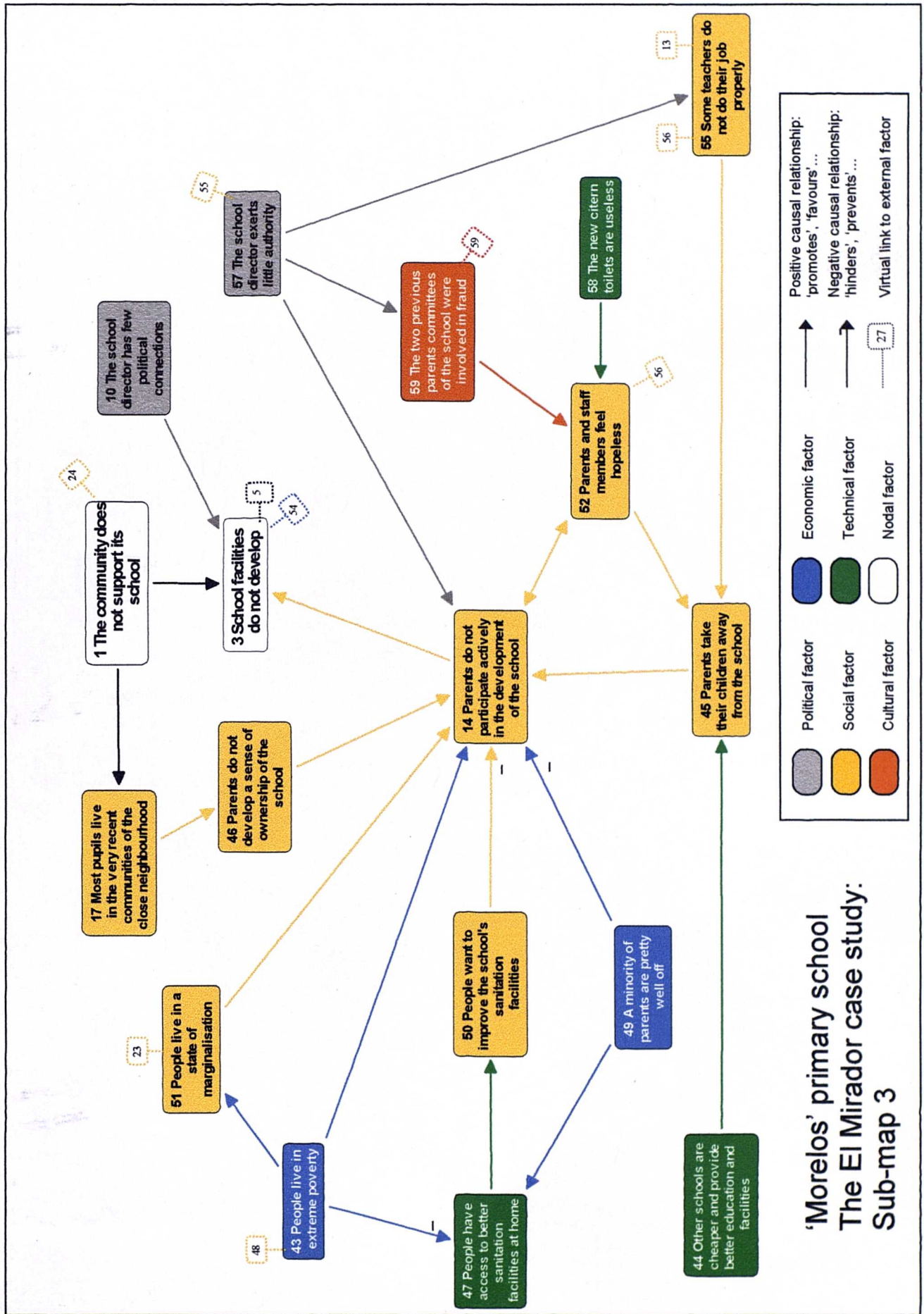
### The Tepezalá case study: Sub-map 4





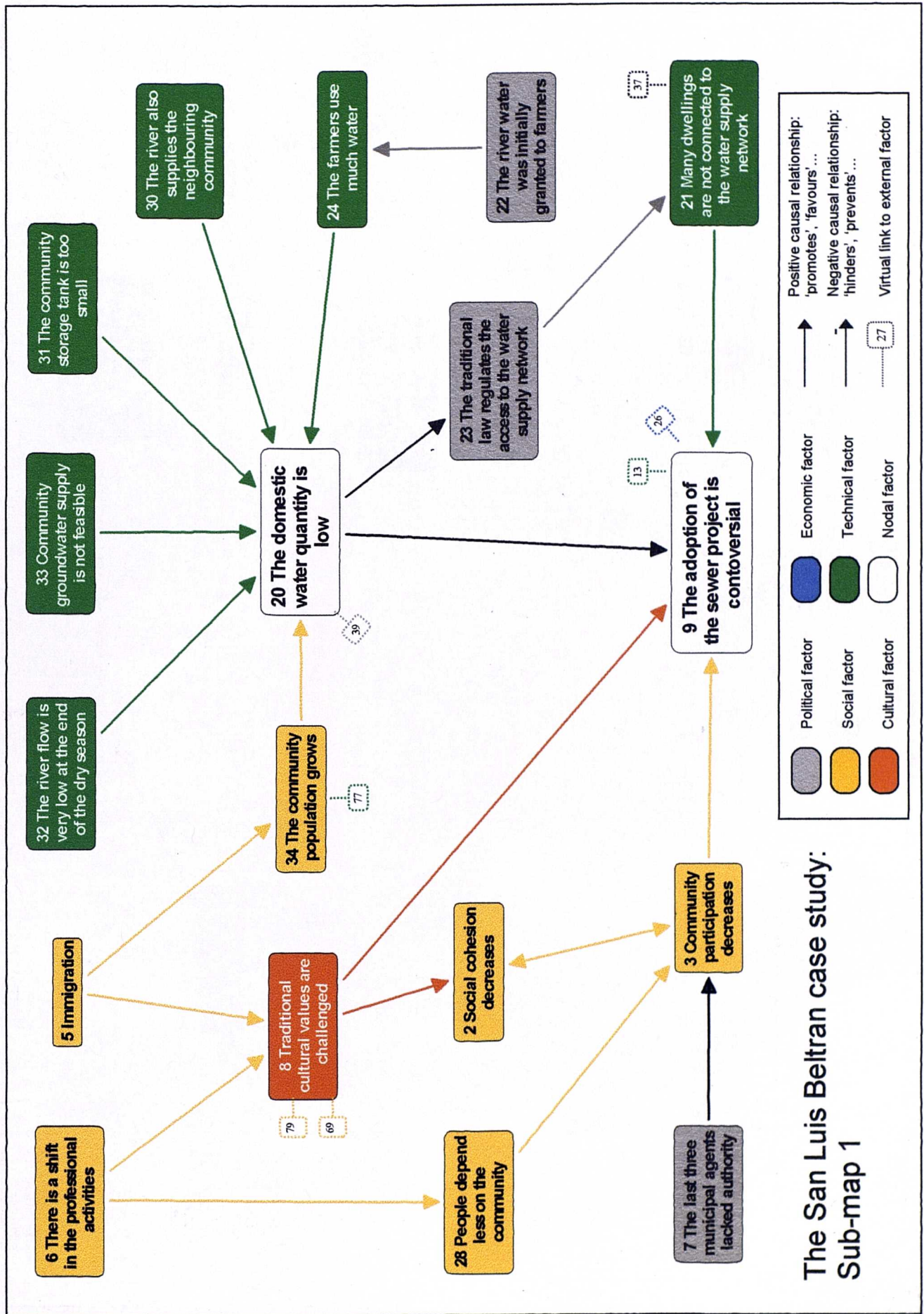


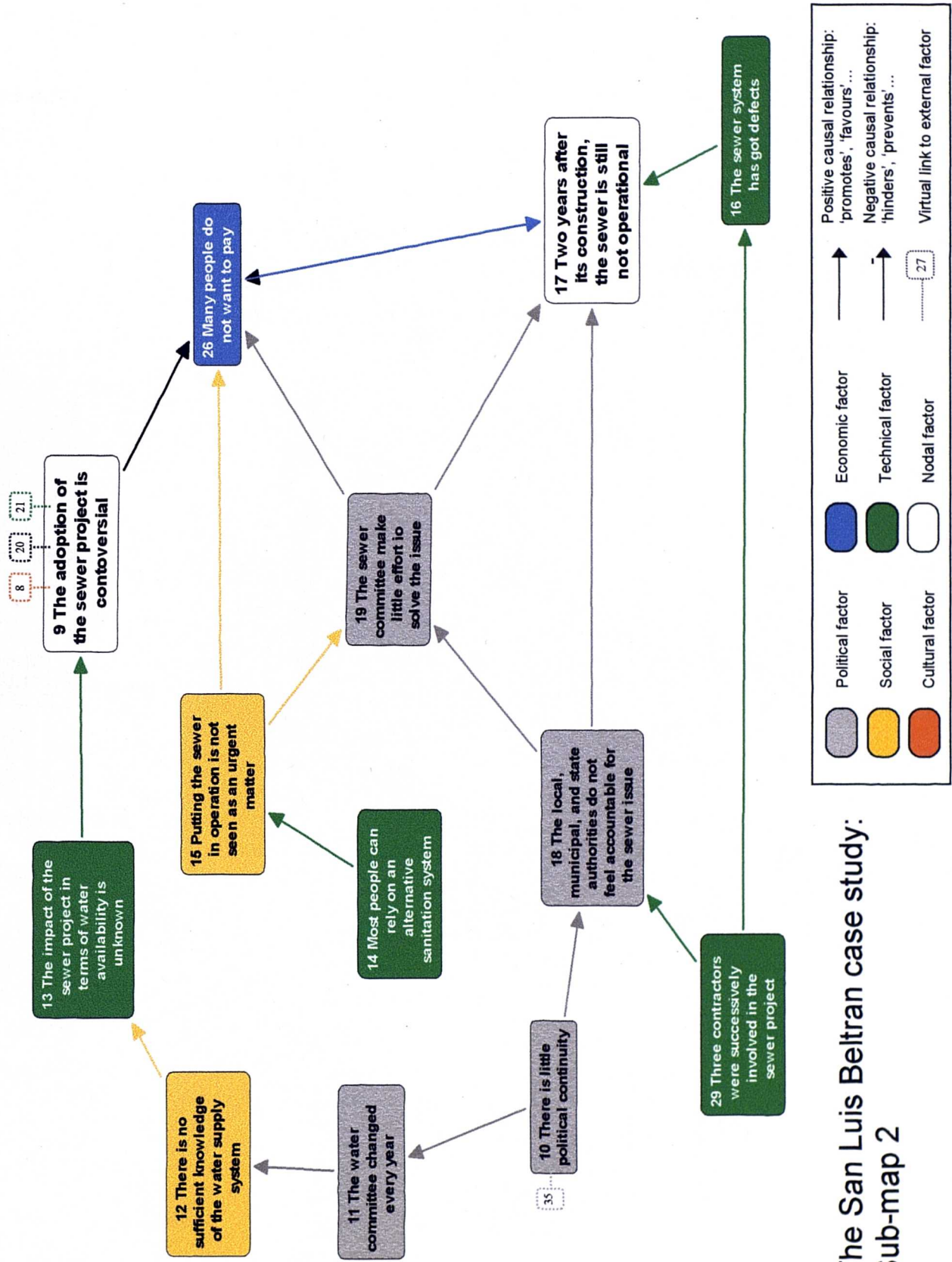






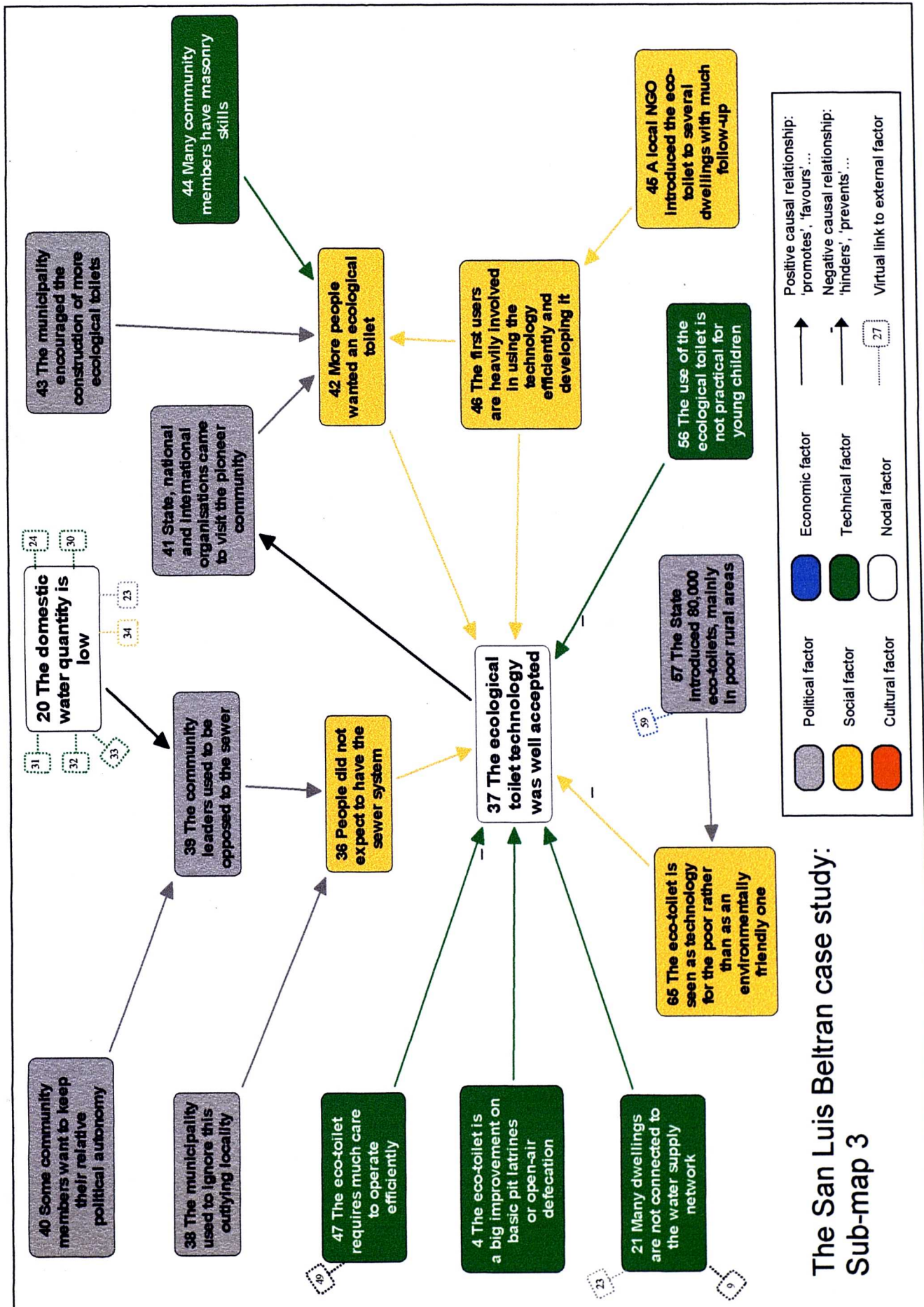




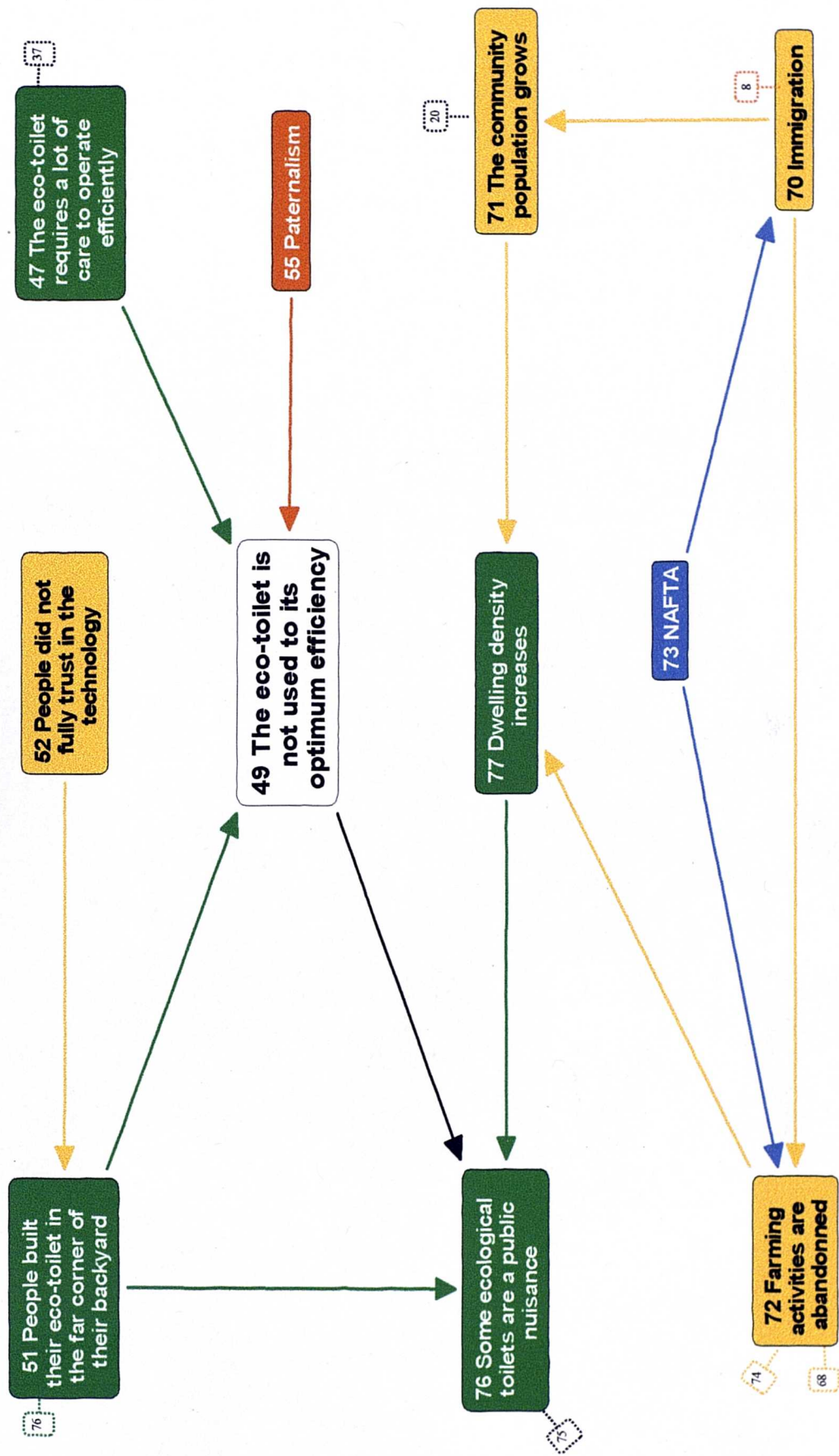


The San Luis Beltran case study:  
Sub-map 2





The San Luis Beltran case study:  
Sub-map 3



Positive causal relationship: 'promotes', 'favours' ...

Negative causal relationship: 'hinders', 'prevents' ...

Virtual link to external factor

Political factor

Economic factor

Social factor

Technical factor

Cultural factor

Nodal factor

The San Luis Beltran case study:  
Sub-map 4



