



ASSESSING BOKU WASH RESEARCH IN TECOLUCA:

Encountered difficulties, proposed solutions and possible paths for the future

Master thesis

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submitted by:

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Abstract

In 2015, a research cooperation was started between BOKU's Institute of Sanitary Engineering and Water Pollution Control, the Austrian NGO INTERSOL and the El Salvadorian municipality Tecoluca. The objective of this cooperation was to create baseline data on Tecoluca's WASH situation.

This master's thesis contributes to this by strategically assessing the research program. The program is assessed on challenges students faced while conducting their field research, the local stakeholders' level of knowledge about and usage of created results and tools, and the stakeholders' visions and recommendations on the future of the research program.

To do this, 54 semi-structured interviews were held with (former) master students, former and current municipality staff and decision makers, community councils and water boards, and others such as local branches of government and other NGOs working in WASH in Tecoluca.

The analysis of these interviews showed that students faced mostly organizational challenges, challenges in cooperation with other partners and ethical challenges during their field work.

The level of knowledge about BOKU results and tools is generally low, and very few instances of usage of them could be found. Stakeholders mainly cited the lack of knowledge about the research program, late or incomplete data delivery and lack of political backing of the program by the municipality as the reasons for this.

For the future of the research program, interviewees most frequently recommended to take measures towards awareness raising and publication.

The organization of a symposium or another form of round table, where stakeholders in Tecoluca's WASH sector can sit down together to form long-term goals, could serve as a platform for awareness raising and dissemination of BOKU WASH results, as well as strengthening the inter-organizational and inter- and inner-institutional cooperation on WASH in Tecoluca.

Zusammenfassung

Seit 2015 existiert eine wissenschaftliche Kooperation zwischen dem Institut für Siedlungswasserbau der BOKU, der österreichischen NGO INTERSOL und der salvadorianischen Gemeinde Tecoluca, mit dem Ziel, eine grundlegende Datenbank über die Trinkwasser- und Sanitärsituation in Tecoluca zu schaffen.

Diese Masterarbeit analysiert das Forschungsprogramm strategisch. Es wurde untersucht auf Herausforderungen, mit denen Studierende während ihrer Feldforschung umgehen mussten, den Wissensstand lokaler Stakeholder über Ergebnisse der Arbeiten und kreierte Tools, deren Nutzung, und die Zukunftsvisionen der Stakeholder für das Forschungsprogramm.

Um das herauszufinden, wurden 54 halbstrukturierte Interviews mit (ehemaligen) Studierenden, früheren und jetzigen Gemeindevertretern und -mitarbeitern, Dorfräten und örtlichen Wasserverbänden, und anderen, wie Vertretern von lokalen Regierungsinstitutionen und NGOs, durchgeführt.

Die häufigsten Schwierigkeiten in der Feldforschung für Studierende waren organisatorischer oder ethischer Natur und in Kooperation mit anderen.

Der Wissensstand über die von BOKU-Studierenden erarbeiteten Ergebnisse und Tools ist sehr niedrig. In nur wenigen Fällen konnte deren Nutzung nachgewiesen werden. Die am meisten genannten Gründe dafür sind die geringe Bekanntheit des Forschungsprogramms vor Ort, zu späte oder unvollständige Ergebnisübergabe, und fehlender politischer Rückhalt für das Programm durch die Gemeinde.

Im Hinblick auf die Zukunft des Programms haben die Interviewpartner größtenteils Maßnahmen zur Bewusstseinsbildung und Bekanntmachung vorgeschlagen.

Die Organisation eines Events oder einer Plattform, bei der Stakeholder des örtlichen Wasser- und Sanitärsektors gemeinsam langfristige Ziele definieren können, könnte zur Bewusstseinsbildung und Bekanntmachung der Forschungsergebnisse dienen. Ebenso könnte dies genutzt werden, um die Kooperation zwischen und innerhalb von Institutionen und Organisationen zu stärken.

Abbreviations

ADCLA.....	<i>Asociación de desarrollo comunitario Lempa Abajo [Association for community development Lempa Abajo]</i>
ADESCO	<i>Asociación de Desarrollo Social Comunitario [Association for social community development]</i>
ANDA.....	<i>Administración Nacional de Acueductos y Alcantarillados [National Administration of Aqueducts and Sewers]</i>
CLARA SPT..	<i>CLARA Simplified Planning Tool</i>
COEM.....	<i>Centro de operación de emergencias municipales [Operation center for municipal emergencies]</i>
DIGESTYC ...	<i>Dirección General de Estadística y Censos [General Directorate for Statistics and Censes]</i>
FUNDE	<i>Fundación Nacional para el desarrollo [National Foundation for Development]</i>
GIS	<i>Geographical Information System</i>
GWP.....	<i>Global Water Partnership</i>
JMP	<i>WHO and UNICEF Joint Monitoring Programme for WASH</i>
MARN.....	<i>Ministerio de Medio Ambiente y Recursos Naturales [Ministry of Environment and Natural Resources]</i>
MIGOBTD	<i>Ministerio de Gobernación y Desarrollo Territorio [Ministry for Governance and Territorial Development]</i>
MINSAL	<i>Ministerio de Salud [Health Ministry]</i>
OECD DAC...	<i>Organization for Economic Co-Operation and Development, Development Assistance Committee</i>
PLANAPS	<i>Plan Nacional de Agua Potable y Saneamiento de El Salvador [El Salvador's National Plan of Drinking Water and Sanitation]</i>
SIBASI	<i>Sistema Básico de Salud Integral [Basic System for Integral Health]</i>
UCA.....	<i>Universidad Centroamericana Simeón Cañas</i>
UCSF.....	<i>Unidad comunitaria de salud familiar [Community unit for family health]</i>
UES	<i>Universidad de El Salvador</i>
WASH.....	<i>Water, Sanitation and Hygiene</i>
WIS.....	<i>Water Information System</i>

1. Introduction

The Institute of Sanitary Engineering and Pollution Control at BOKU has an ongoing cooperation with the municipality¹ of Tecoluca, El Salvador and the Austrian NGO INTERSOL. The aim of that cooperation is to aid the other participating parties in the improvement of Tecoluca's drinking water supply and sanitary system via the gathering of scientific information. This cooperation was started in 2015 and (including the present one) 10 master theses have been carried out/are in the process of being carried out.

Further information on the cooperation and the content of the respective master theses can be found in Schaidreiter (2016), Biber (2016), Rossmann (2017), Liemberger (2018), Schütz (2018), Lasser (2018), Kern (2018), Döber (2018), Wiesmair (in progress) or in Chapter 3.3.

In the area of development cooperation and the research on it, it is considered good practice to evaluate and strategically assess one's work (OECD DAC, 1991). For this reason, after five years and nine theses it was decided to take a step back and conduct a strategic résumé of the realized works.

This master thesis now represents this résumé. It was an objective to shine light on results achieved and difficulties encountered in the cooperation so far, real and perceived impacts of the realized works and suggestions for improvement. During a four month stay in Tecoluca from March to June 2019, key stakeholders in the previous works were identified and 54 semi-structured interviews were conducted. The interviewees included previous students, representatives and staff at the alcaldía, the local cooperation partner, representants of cooperating Salvadorian universities, organisational committees of cooperating villages, and individuals who cooperated in the previous works.

These interviews were then analysed to find challenges students experienced during the realization of their work, knowledge about and impact of finalized studies and tools, and stakeholders' recommendations for the future of the research cooperation. So, it was attempted to depict three stages of the scientific cycle: the realization of the studies, their impacts (approximated via the level of knowledge about the results and tools and their usage) and possible paths for the future.

Thus, the present work can serve as a basis for decisions regarding the research program and adaptations in the cooperation and the continuation of the scientific work in Tecoluca.

¹ Unfortunately, there exist language barriers between the English and the Spanish language. 'Municipality' can be used to refer to the mayoral office (El Salvadorian Spanish: 'alcaldía') as well as the corresponding governed community (Spanish: 'municipio'). Here, it is used to refer to the mayoral office. From Chapter 2 onward, for purposes of exactness, the term 'municipality' will be used to refer to the governed community (i.e. the place) and 'alcaldía' to refer to the mayoral office.

2. Objectives

As mentioned in the Introduction, the aim of this thesis was the following:

The objective was to draw a résumé of the previous theses. This résumé should include a stock taking of the knowledge about and the usage of previously created results and tools among relevant stakeholders. It should also take a step further and include the difficulties encountered in the cooperation in the past and the stakeholders' proposals and solutions for future works.

In order to try and meet this objective, an action research approach was taken. 54 group and individual interviews were conducted, and meetings and paths of cooperation were organized (or at least tried to organize). Further information on how this was done, and the obtained results can be found in the following chapters:

Chapter 3 (Fundamentals) gives an overview over the cooperation and its results, as well as a short introduction to the methods of evaluation and impact assessment in development cooperation.

In Chapter 4 (Materials and Methods), the methodical approach and the applied methods are presented and discussed.

Chapter 5 contains the Results and Chapter 6 their Discussion, which are finally condensed in Chapter 7 (Conclusion and Outlook).

Chapter 8 contains a summary of the thesis.

3. Fundamentals

3.1 Water and Sanitation in El Salvador

The general drinking water and sanitation situation of El Salvador is of course the starting point for the assessment of WASH research in Tecoluca, El Salvador. Detailed information on this subject can be found in the master theses that were previously created within this research program (Schaidreiter, 2016; Biber, 2016; Rossmann, 2017; Liemberger, 2018; Schütz, 2018; Lasser, 2018; Kern, 2018; Döber, 2018).

Here, only a short overview shall be given:

Figure 1 shows El Salvador's service levels following WHO's and UNICEF's Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP):

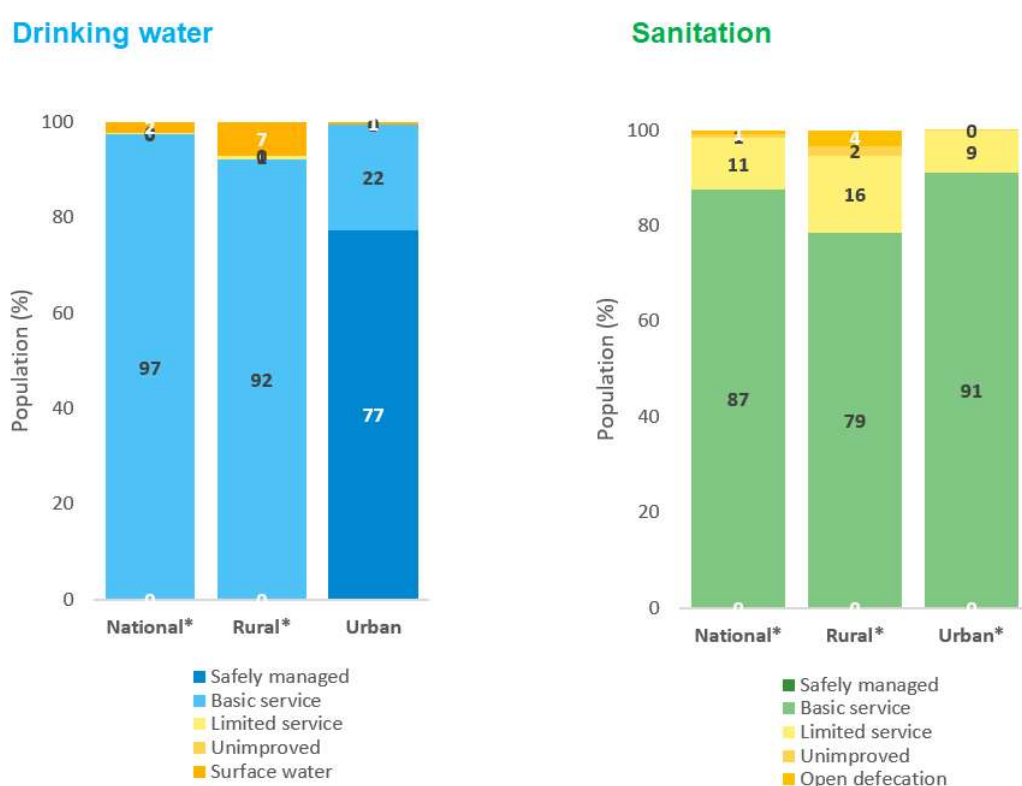


Figure 1 Water Supply and Sanitation Service Levels in El Salvador. Source: JMP 2019

As shown, 97% of all Salvadorians can count on at least basic drinking water service, but following the nationwide overview, none can count on what is classified as a 'safely managed service'.

The latter classification refers to improved water sources that are located on premises, free from fecal and chemical contamination and available when needed. In contrast to this, 'basic service' refers to an improved water source within a distance of 30 min, but contamination cannot be excluded. 'Limited service' refers to an improved water source in a distance exceeding 30 min and an 'unimproved source' is water taken from unprotected wells or springs. (Lasser, 2018 from JMP, 2015)

This situation is even exacerbated in rural areas, where only 92% of the population have access to basic service, while the remaining 8% must rely on unimproved sources or surface water.

When it comes to sanitation, no examples for safely managed services can be found in El Salvador. 87% of the total population have access to basic service and the rest either to limited or unimproved service, in rural areas these numbers are 79% for basic service and 18% for limited or unimproved service. Also, in rural areas, 4% of the population cannot count with any sanitation service whatsoever.

In the area of sanitation, JMP's classification of 'Safely managed' refers to a private improved facility, where faecal wastes are safely disposed on-site or transported and treated off-site where also a hand-washing facility with soap and water is present. A facility is referred to as 'basic', when it is a private improved facility which separates excreta from human contact. When service is 'limited', the improved facility has to be shared with other households. Sanitation service is classified as 'unimproved', when excreta are not separated from human contact. (Schütz, 2018 from JMP, 2015)

Tecoluca's specific performance in WASH will be discussed in 3.2.

These numbers show that even though efforts towards the improvement of the country's WASH situation have been successful, more work needs to be done still.

Another challenge, that is outlined in Kern (2018, from ANDA, 2016 and Martínez, 2016), is that in El Salvador theoretically sufficient water is produced to satisfy the drinking water demand of its population. However, inadequate institutional structures and inefficient operation and maintenance have led to huge water losses within distribution systems. For 2016, a loss of 160.1 million m³ has been cited.

3.1.1 Legal and Institutional Framework for the El Salvadorian WASH sector

The regulation, administration and management of the water and sanitation sector in El Salvador proves a challenge for El Salvadorians. As the Global Water Partnership (GWP) put it in a 2011 report:

"The delivery of water and sanitation services in El Salvador is characterized by the inexistence of regulation in the sector, juridical insecurity and the lack of a public institution responsible for the quality and sustainability of the sector." (GWP Central America, 2011, p. 111)

This quote shows that there is no countrywide law on water, which is frequently mourned and blamed for adverse effects in water management (MARN, 2017; GWP Central America, 2017; Gobierno de El Salvador, ANDA & TYPSE-ENGEORPS, 2017; FUNDE 2018; UN Environment, 2018).

This leads to a void in regulation and administration that not only allows for mismanagement, but also to a distribution of WASH governance among a multitude of actors. Several ministries (and connected agencies) and autonomous institutions have created technical norms, plans or recommendations that touch upon drinking water and/or sanitation. See for instance MARN (2017), Biber (2016, from MINSAL, 2009, 2015), and Döber (2018, from MARN, 2016).

As always, the previous works can be consulted for a more detailed run-down of relevant institutions and corresponding regulations and responsibilities. However, probably due to the sheer number of actors in the sector, the pictures drawn by the various authors touch on different aspects and actors in the sector. A comprehensive list of legislation and actors in the sanitation sector can be found in Schütz (2018, p.14-19). For the water sector, Schaidreiter (2016), Liemberger (2018), Lasser (2018) and Kern (2018) all offer additional insights.

To give a complete overview, reference is taken to the *Plan Nacional de Agua Potable y Saneamiento de El Salvador* [National Plan on Drinking Water and Sanitation in El Salvador]

(PLANAPS) (Gobierno de El Salvador, ANDA & TYPSE-ENGECORPS, 2017). This document was elaborated in cooperation with 30 public institutions, 12 civil society organizations, and 35 water boards. It contains a joint picture of El Salvador's WASH sector as well as goals and plans for the future.

The identified relevant institutions are:

*Table 1 Governing institutions in El Salvador's WASH sector. Source: PLANAPS 2017 (if not marked with *)*

Secretaría Técnica y de Planificación de la Presidencia [Presidential Technical and Planification Secretariat]	STPP takes a coordinating role in the sector.
Administración Nacional de Acueductos y Alcantarillados [National Administration of Aqueducts and Sewers]	ANDA is an autonomous institution ² that is responsible for providing, maintaining and operating drinking water and sanitation services, as well as conduct investigations towards these topics and introduce relevant norms.
Juntas Administrativas de Acueductos Rurales (JAAR) [Administrative Water Boards of Rural Aqueducts] or other rural associations	Rural Water Boards are legal entities for water management formed by inhabitants of villages where their water source is locally managed
Ministerio de Salud (MINSAL) [Health Ministry]	MINSAL is the entity responsible for the drinking water quality. For this, norms are issued, inspections are executed and other measures for public health are taken.
Ministerio del Medio Ambiente y Recursos Naturales (MARN) [Ministry of Environment and Natural Resources]	MARN's responsibility falls to environmental and natural resources. As such, it is responsible for the quality of natural water bodies
Ministerio de Gobernación y Desarrollo Territorial (MIGOBDT) [Ministry of Governance and Territorial Development]	This ministry influences El Salvador's WASH situation twofold: -firstly, they are responsible for the organization and maintenance of disaster prevention and response systems. -Secondly, they are eponymously responsible for territorial development. This makes them a theoretically big player in rural areas, as they are the ministry responsible for rural Water Boards and rural ADESCOs (for Definition, see chapter 3.2.1.1). However, the PLANAPS also states that no real controlling body and nationwide regulation system for rural water associations exists.

2 Autonomous Institution: An institution that is outsourced from the government's direct leadership but still remains under the corresponding ministry's supervision (Asamblea Legislativa de la República de El Salvador, 1983; Directorio Cívico Militar de El Salvador, 1961; Lopez de la O & Peña Iraheta, 2007).

Fondo de Inversión Social para el Desarrollo Local (FISDL) [Social Investments Fund for Local Development]	This fund was created to promote local development and infrastructure. Thus, it is theoretically the entity responsible for inversions in rural water and sanitation systems, in cooperation with alcaldías, local committees and boards, and private firms. However, it is not the only actor who does so.
Alcaldías*	<p>This player is not specifically mentioned in the PLANAPS list of governing institutions. However, alcaldías are responsible for ‘public service delivery’ in general and some alcaldías act as the operators of their municipality’s drinking water system (Schaidreiter, 2016; Liemberger, 2018).</p> <p>This fact is also referred to in another place of the PLANAPS, where the inefficiency caused by the duplicity in service offerings and providers is lamented (Gobierno de El Salvador, ANDA & Consorcio TYPASA-ENGECORPS, 2017). ANDA and alcaldías are given as an example. A possible reason for the omissions of the alcaldías in this list is that one goal in the PLANAPS is the eradication of duplicity in service provision.</p>

As is stated in Table 1, ANDA is the governing body responsible for provision of aqueducts and sewers, with ‘aqueducts’ in this context referring to drinking water systems from source to consumer and ‘sewers’ referring to complete waste water treatment and disposition chains (Directorio Civico Militar de El Salvador, 1961).

In the founding law of ANDA (see ibd.) it is stated that it is their responsibility to provide these services to ‘the inhabitants of the Republic’, which seems to indicate that they are responsible for all El Salvadorians.

However, in reality this is not the case. In fact, ANDA is only responsible for 40% of all drinking water systems in the country, while 30% are managed by independent water committees and cooperatives, 25% of inhabitants are without access, 2% each are managed by decentralized service providers or self-supplied systems and 1% of all systems are managed by alcaldías (Liemberger, 2018, from World Bank, 2006).

The PLANAPS also offers a resumé on the legal and normative framework in WASH. As they mention, there are “*over ten unspecific instruments [...] that regulate aspects related to drinking water services, evacuation, disposition and treatment of waste water, [that are found] in different laws, regulations and technical norms*” (Gobierno de El Salvador, ANDA & Consorcio TYPASA-ENGECORPS, 2017, p.25).

The list presented there is a collection of 21 laws, regulations, and nationwide as well as only institution-wide norms that the participating 87 institutions and organizations consider comprehensive.

This shows that the amount of relevant laws, regulations, norms and technical guides is massive. The PLANAPS itself mentions that key players, such as rural water administration boards, often lack critical legal knowledge on the subject (Gobierno de El Salvador, ANDA & Consorcio TYPASA-ENGECORPS, p.28). The sheer number of relevant laws may be one of the reasons for this.

Based on the number of relevant institutions and laws/regulations/norms/guidelines/plans, it can be confusing to discern which of them are most relevant in practice at the municipality level. In chapter 3.2.1, an attempt is made to paint an -ideally complete- picture of water governance in Tecoluca.

3.2 Description of the Study Area

Now that regulations at national level have been defined, we can focus specifically on the researched area: the municipality of Tecoluca and encompassed regions and villages.

The municipality is located in the department of San Vicente and covers an area of 284.6km².

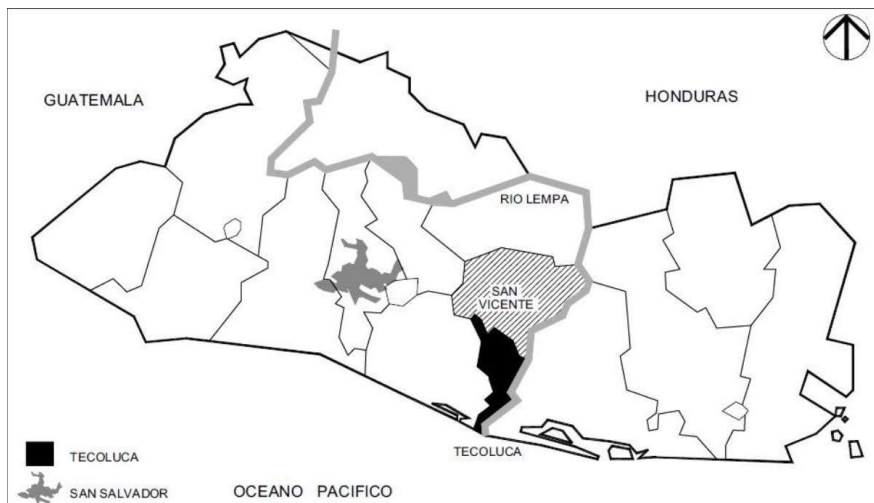


Figure 2 The location of Tecoluca in El Salvador. Source: Schaidreiter, 2016 from FUNDE, 2015

In El Salvador's 2007 Census (DIGESTYC, 2019), there were counted 23.893 inhabitants in Tecoluca, 43.8% of them living its urban area. Schaidreiter (2016) refers to more recent data from 2015 and cites that there are 29.545 inhabitants, with 9.9% of them living in the urban area³.

It is also important to note that Schaidreiter's data from MINSAL refers to the 'health area' Tecoluca (i.e. the area that falls under the responsibility of the health unit that is responsible for Tecoluca) and not the municipality of Tecoluca. This means that some villages, that are not part of the municipality but fall under the health unit's responsibility, are included in this number, while some others are excluded. (Acosta, 2019a)

In this data set, that was available to Schaidreiter, it is also stated that in the urban area, water is piped on premises in 99.5% of households. In the rural area, this is the case in 86.4% households, in 6.2% the households have access to a protected well, in 4.8% people use 'other sources' and in 1.3% each, they use public taps or surface water as their drinking water source.

³ This considerable difference in the ratio of urban versus rural population may be due to differing definitions of 'urban' and 'rural'. The 2007 census was realized by the Dirección General de Estadística y Censos (DIGESTYC) [General Directorate of Statistics and Censuses], which belongs to the Ministerio de Economía [Ministry of Economy]. Their definition of 'urban area' can be found in DIGESTYC (2007, p.15). The data Schaidreiter (2016) refers to, was collected by MINSAL. MINSAL's criteria for qualifying an area as 'urban' or 'rural' could not be found. In their 2017 guideline for health units, they state several times that levels of urbanization of settlements need to be determined and settlements need to be separated in 'urban' and 'rural' areas before the realization of their censi (for organizational reasons) (MINSAL 2017, p.28-30, p.79, p.86). However, their criteria for this categorization are not stated in this document.

Regarding the municipality's sanitary situation, Biber (2016) gives the following numbers based on the same data set: 84% of households have access to improved sanitation, 11% have no access and for 5%, no data exists.

Comparing these figures to the national average (see Figure°1), service levels in Tecoluca seem to be lower in all counts, apart from the drinking water service level in urban areas.

In chapter 3.3, the research project in Tecoluca is discussed and in the course of this, also some of the BOKU students' results on Tecoluca's WASH situation will be resumed.

The following subchapter gives an overview of WASH governance in the municipality.

3.2.1 WASH governance and research in Tecoluca

As seen in 3.1 there is a huge amount of governing institutions in the El Salvadorian WASH sector. Following Steurer's definition of governance from 2013, NGOs and private firms are also important players in the sector and its governance.

For this thesis, it was necessary to determine relevant stakeholders in Tecoluca's water governance. This attempt was made by drawing a conceptual map with the help of local cooperation partners (Herberth Sanabria, the local contact person in the alcaldía and Aida Sandoval, his wife and doctor at the UCSF III (Básico) Santa Marta). This conceptual map was updated in the course of the interviews, when interview partners could offer additional information. The full map can be found in the Appendix (Chapter 9, Attachment 4).

While it was strived to paint a complete picture, eventual omissions can't be excluded and are the sole responsibility of the author.

3.2.1.1 Government institutions

Governing institutions at national level have been discussed at length in 3.1.1. Governing actors that are relevant for Tecoluca at **supra-regional level** are:

- COMURES (Corporación de Municipalidades de la Republica de El Salvador [Corporation of Municipalities (here: in the sense of Alcaldías) of the Republic of El Salvador]), the organization of alcaldías that represents the alcaldía's joint interest at national level (COMURES, 2019). A part of COMURES are also the 6 CDA (Concejos de Alcaldes [Councils of Mayors]), which are the departmental sub-organizations of COMURES (COMURES, 2019).
- The departments themselves (San Vicente for Tecoluca) are merely administrative units without legal and financial autonomy (in contrast to the alcaldías) (Asamblea Legislativa de la Republica de El Salvador, 1983). A governor and a departmental cabinet of representatives of all relevant ministries exists for each department, but their function is rather as an instance of contact and complaint for citizens rather than the making of legal decisions (Menjivar, 2019; Rodriguez, 2019)
- The Association of Municipalities (here: in the sense of Alcaldías) 'Los Nonualcos' is an association of 18 municipalities (as mentioned, the representative members in this case are the alcaldías) located in the departments La Paz and San Vicente, one of them being Tecoluca. Their aim is to work together to promote the integral and sustainable development of their members. One of their foci is sustainable and environmentally friendly development, with educational and guidance projects for the alcaldías' environmental offices. Projects concerning drinking water and sanitation are also conducted in cooperation with them, but not in the case of Tecoluca (Alvarado, 2019).

- One ministry that plays a big role in the El Salvadorian WASH sector at all levels (from national to local), is MINSAL. The Health Ministry operates in all parts of the country on one hand by the operation of hospitals, on the other hand by the operation of 'consulting offices' for first response. At departmental level, this task falls to the so-called 'SIBASI' (Sistema Básico de Salud Integral [Basic System for Integral Health]) in San Vicente (MINSAL, 2015). In San Vicente, there is also a responsible office for sanitation, that oversees the health inspectors of the responding health areas (which are basically the municipalities) (Rodriguez, 2019).

The explanation of their roles in this list shows that the supra-regional 'governing' bodies in WASH in El Salvador take a mostly representative and organizational role in the case of Tecoluca. The 'real' players in El Salvadorian regional governing are the *alcaldías* (Asamblea Legislativa de la Republica de El Salvador, 1983, 1986).

Thus, follows WASH governance at the **municipal level**:

- The *alcaldía*: Is as mentioned, an autonomous government institution with its own budget, legislative power via the 'Ordenanzas Municipales' [Municipal Ordinances], which are decreed by the Concejo Municipal [municipal council], and right to raise taxes (ibd.).
 - As this statement shows, the first governing bodies within the *alcaldía*, that have the power to affect the municipal WASH situation, are the *mayor* and the *municipal council* (Alcaldía Municipal de Tecoluca, 2018). They 'hold the purse strings', so to speak, when it comes to all investments, plans and ordinances taken and issued by the *alcaldía* in all areas (Asamblea Legislativa de la Republica de El Salvador, 1986), and of course also in WASH.
 - The *alcaldía* not only consists of the legislative part represented by mayor and council, but also *administrative offices*. The following information is taken from the *alcaldía*'s current organigram (Alcaldía Municipal de Tecoluca, 2018). Only the administrative offices directly involved in WASH governance and administration are presented⁴:
 - *Office for International Cooperations*⁵: This office is headed by Herberth Sanabria, the local contact person for the cooperation with BOKU at the *alcaldía*. Thus, the work of his office affects the local WASH situation twofold: Once, via the projects and research works in WASH related topics realized by volunteer students (not only of BOKU). Twice, through the office's responsibility to coordinate the emission of the *alcaldías* strategic plans.
 - *Office for Environment and COEM*: This office was formed in the course of the new administration and did not previously exist. Two roles, that are now part of the environmental office, did in fact exist previously: The 'Judge of Water' and the 'COEM'. The 'Judge of Water' works as a jury in

4 As stated, the election of 'which actors are relevant' was taken based on advice of local cooperation partners. Eventual omissions are the author's responsibility, as always.

5 Again, we are confronted with a language barrier between English and Spanish. The Spanish name for the office is 'Relaciones y Gestión', which literally translates to 'Relations and Management'. The adaptation in the translation was made to differentiate the office from the actual 'management office' (which is the office of 'Gerencia') and the actual PR office (which is the office of 'Comunicaciones').

irrigation issues and as (one of the) contact person(s) for local water boards (Jovel, 2019). The representative of COEM (Comisión Municipal de Protección Civil, Prevención y Mitigación de Desastres [Municipal Commission for Civil Protection, Disaster Prevention and Mitigation]) is responsible for the alcaldía's natural disaster response and plan maintenance (COEM, 2018).

The environmental office itself also works in water related topics, but up to now the focus has been on agricultural water use (Amaya, 2019; Alcaldía Municipal de Tecoluca, Unidad de Medioambiente, 2019).

Another plan for the future is the creation of a municipal environmental association with members of all sectors. This had not been realized up to June 2019. (Amaya, 2019)

- *Project Office*: The 'Project Office' is the entity for the technical planning of all investment projects. Thus, they play a great role in the alcaldía's impact on WASH as they decide the technical details of a construction project in water supply or sanitation, such as the type of latrines built, the type of supervision of construction and usage conducted etc. (Caranza, 2019; Alcaldía Municipal de Tecoluca, Unidad de Proyectos, 2014, 2015, 2016, 2017, 2018, 2019).
- *Cadastre Office*: As the spatial planning entity at the alcaldía, this office of course also impacts the municipality's WASH situation.
- *Office for Citizen Organization and Participation*: This office is the official link between alcaldía and community organizations, such as ADESCOs and water boards. They support the community organizations in all bureaucratic steps from their forming to everyday bookkeeping. (Alfaro, 2019)

To achieve this goal, the office counts with so-called '*Social Promoters*', who are alcaldía employees acting as mouthpieces between the organizations and the alcaldía by attending their board meetings and general assemblies. Their role is purely communicational, they (or the alcaldía) don't hold direct authority over the organizations. (Villagas, 2019)

Ideally there are 7 in the municipality, each responsible for one region, but in reality, the number varies (Sanabria, 2019).

- Two more offices will be mentioned, even though their role is far less central for water supply and sanitation: the *IT office* and the *Communications office*. These two are mentioned here even though their link to WASH is less direct than for the aforementioned ones. However, Rossmann (2017) cooperated with members of both offices in the course of his thesis.
- Another relevant player in WASH is again MINSAL. At the municipal level, MINSAL acts via the UCSFs levels I and II (the roman letters refer to the centrality and equipment of the units), with UCSF referring to 'Unidad Comunitaria de Salud Familiar' [Communitarian Unit for Family Health']. They are basically small first response ambulances but are also highly important in Tecoluca's WASH governance. The reason for this is the following: The three UCSFs I house the three health inspectors responsible

for Tecoluca, and the seven UCSFs II house at least 2 'health promoters' each⁶ (Acosta, 2019a).

Among the health inspectors' responsibilities fall the quality vigilance of drinking water supply systems and the maintenance of drinking water systems – and sanitation – related data that is collected by MINSAL (Organismo Salvadoreño de Reglamentación Técnica, 2018).

The health promoters on the other hand are employees of the UCSFs II and conduct house visits at all households that fall under the respective UCSF II's responsibility. The regulation asks for at least one house visit per year for each house. In these house visits, they are expected to check and converse on a variety of health-related issues. One of them is on sanitation and hygiene, where they check the houses' sanitary situation and hygienic conditions and advice the population on sanitary conditions and conduct if necessary. They also complete annual questionnaires (so-called 'Fichas Familiares' [family reports]) about all households on demographic data, educational and employment information, housing conditions, drinking water supply and sanitation systems. (MINSAL, 2015a)

These family reports are processed in MINSAL's IT system for each UCSFI and II (ibd.), but are also collected in pencil and paper form as community-level résumés. The persons responsible for the collection of all of these résumés in the health area Tecoluca are the two head health promoters at the two bigger UCSFIs. Thus, they also play a certain (hypothetical) role in Tecoluca's WASH governance and monitoring, as they are the ones that maintain Tecoluca's only annually actualized household census data on drinking water and sanitation (and, in fact, Tecoluca's only generalized, annually actualized census in general).

- ANDA provides drinking water services for the urban core of central Tecoluca and a system in San Nicolás Lempa called 'Las 90' [The 90ies] (Acosta, 2019b).
- 27 of the remaining 28 drinking water systems in Tecoluca are classified by the health inspectors as communally managed, while one system is classified as 'privately managed'⁷ (ibd.).
- This means that in Tecoluca, 27 different water boards or water committees are responsible for their communities' drinking water supply systems. These systems supply either single villages or whole regions (as is the case for ADCLA which supplies almost all of Bajo Lempa in the south of the municipality) (ibd., Schaidreiter, 2016). The difference between 'water board' [junta de agua] and 'water committee' [comité de agua] is whether the organization has its own legal entity. A water board is a fully formed and registered organization, while a water committee 'borrows' its legal stance from the corresponding ADESCO. In theory, only water boards are allowed to administer drinking water systems. (Barrera, 2019)

6 As already mentioned, it must be noted that the 'health area' Tecoluca is not synonymous with the municipality of Tecoluca. The UCSFII all correspond to one of the three UCSFI of Tecoluca and the UCSF's II each have their responding communities of attendance. Some communities at the borders of the municipality are attended by UCSF's of other municipalities, while some communities of other municipalities are attended by Tecoluca.

7 It is not clear, what 'privately managed' refers to.

- The ADESCOs⁸ themselves are also relevant players, not only in cases where they illegally borrow their legal entity to water committees. Rather, they are the corresponding local governance body on sanitation issues. In some villages, specific health committees exist which focus on sanitation and hygiene among other topics (Water Board of El Milagro, 2019).

Now that the relevant government institutions in Tecoluca are finally recorded, a short overview of non-governmental players in Tecoluca's WASH governance process will be given.

3.2.1.2 NGOs

National and international NGOs can play a big role in a country's WASH sectors, as they may try to fill gaps left by the local government. An example for this can be found in Naiga et.al. (2015) for the Ugandan drinking water sector, where NGOs were found to carry out projects that even contradicted national legislations when they found the official channels as too slow-working.

Also in Tecoluca, NGOs take an important role in the inversion and strategic planning in and of WASH related topics. An indicator for this can be found in the following: When drawing up the conceptual map of relevant actors, not even the head of the alcaldía's office of international relations could name all cooperating NGOs with certainty. He stated that nowadays, an effort is made to centralize all NGO led projects via cooperation agreements that include the alcaldía as a partner. However, this has not yet taken place for all NGOs acting within Tecoluca. Especially 'hermanamientos' [town twinnings], which are formed between cities in other countries and communities within Tecoluca, do not require the local alcaldía for their formation. (Sanabria, 2019)

Considering this (partial) lack in centralized information, not even an attempt at depicting Tecoluca's NGO landscape will be made here. However, the conceptual map in the Appendix (Chapter 10, Attachment 4) does contain numerous NGOs from international to communal level acting in Tecoluca.

3.2.1.3 Private Firms

A depiction of an area's governance scene can't be complete without looking also at the private sector (Steurer, 2013). However, basically no relevant private actors in WASH in Tecoluca were encountered (which is not to say that they do not exist). There are two exemption to this:

The first is Enersys Solar, a company that operates a solar energy plant in El Milagro. Their connection to WASH is that they have an agreement of support with the community of El Milagro. This agreement was made to strengthen the solar energy plant via the strengthening of its neighbouring community. It allocates a certain annual budget to the community of El Milagro that can be used for public investments. Funds stemming from this agreement have been used for purchasing a mechanic pump for a newly drilled well. (Infante, 2019)

The other is the cooperative association 'Juventud Rural del Bajo Lempa' [Youth of Bajo Lempa], which has a factory in El Playón in which they manually create biological drinking water filters (Asociación Cooperativa Juventud Rural del Bajo Lempa, 2016).

⁸ 'ADESCOs' (Asociaciones de Desarrollo Comunitario [Associations of communal development]) refers to the governing organizations of El Salvadorian villages. In the country's Código Municipal [Municipal Code] they are referred to simply as 'Asociaciones Comunales' [Communal Associations] (Asamblea Legislativa de la República de El Salvador, 1986). The name 'ADESCO' is used here, because it is the commonly used term in Tecoluca for referring to the communal associations. Their responsibilities and rights following the Municipal Code are to represent the community in their needs and problems in an organized manner (ibid., p.33).

3.2.1.4 Universities

While universities aren't exactly key players in Tecolucan WASH governance, they are still mentioned here as they of course play a big part in the research towards WASH.

The first university to be mentioned in this list will of course be BOKU. Two national universities with which BOKU students have cooperated in the past (see Chap. 3.3) are UES (Universidad de El Salvador) and UCA (Universidad Centroamericana Simeon Cañas) (Schaidreiter, 2016, Biber, 2016, Rossmann, 2017). Both universities have conducted WASH-related research projects (as part of theses and otherwise) in Tecoluca, independent of their cooperation with BOKU (Deras Aquino et.al., 2016; Grande Cobar, et.al. 2017). UES continues to do so to this day (Herrero Jáuregui & Cruz, 2019).

Other Spanish and French universities have been sending students and trainees in this field to the municipality, but will not be discussed in detail, as the local cooperation partners could not guarantee the completeness of the information (Sanabria, 2019).

3.3 The research cooperation between Tecoluca, BOKU and INTERSOL

It all started with INTERSOL (Eder, 2019). In the early 90's, Hans Eder, the current Director of INTERSOL, co-founded the regional development cooperation between two departments 'Regionalkooperation Salzburg-San Vicente' and in the process of this, the organization INTERSOL itself.

The cooperation was broadened around ten years later by an additional cooperation between several Austrian communities of the Fuschlsee region and the alcaldía of Tecoluca, which is located in the department of San Vicente (ibd.). The topics of this cooperation focus on water, f.i. the construction of spring captures and smaller sanitation projects. (ibd., Schaidreiter, 2016, p.12).

Within the framework of the cooperation between the Fuschlsee communities, INTERSOL and the alcaldía of Tecoluca, it became clear that basic systematic information on the municipality's drinking water and sanitary situation was sorely lacking. This of course complicated sustainable and effective interventions and inversions in Tecoluca's water and sanitation infrastructure (Eder, 2019).

This lack of centralized routine information on water topics is not uncommon for development countries and often leads to water management processes being a shot in the dark (Tollan, 2011).

At this point, the Institute of Sanitary Engineering and Water Pollution Control of the University of Natural Resources and Life Sciences Vienna entered the cooperation: From 2015 onward, the institute began sending master's students who carried out their master's theses in Tecoluca (Eder, 2019). At this point in time, 10 students (including the author) have completed their stay in Tecoluca.

The overall objective of the program has been, and still is, to gather information and create a basic database on Tecoluca's water resources and its water supply and sanitation situation, also in cooperation with local universities. The topics of the theses, that have been conducted so far, have of course varied depending on the authors' specific objectives and also adaptations to local conditions and encountered difficulties.

The following resume the realized research, one for research done in water, the other for sanitation.

Tables 2 and 3 show that at the beginning, both in water and in sanitation, efforts were made to cover the whole municipality including the documentation of all results in a WebGIS (Schaidreiter, 2016; Biber, 2016; Rossmann; 2017).

This approach changed towards the realization of 'Community Diagnostics' to give detailed insights on the villages' WASH situations (Liemberger, 2018; Schütz, 2018; Lasser, 2018; Kern, 2018). In the most recent study using this approach, Wiesmair (in progress) used this approach to cover Bajo Lempa, a whole region of Tecoluca.

Döber's work from 2018 presents an outlier with his adaptation of the CLARA SPT.

In Chapter 5 (Results), the levels of knowledge about the results and tools are evaluated by the three groups of studies conducted, these being 'Group WIS', 'Group Community Diagnostics' and 'Group SPT'.

Table 2 Studies conducted by BOKU students on Tecoluca's drinking water situation

Author (Year) Title	Stay in Tecoluca	Objective	Methods	Selected Results	Selected Conclusions
Schaidreiter (2016) Establishment of a GIS Database for Water Resources Management: A Case Study in Tecoluca, El Salvador	March - July 2015	Original: Collect basic data on all 30 water sources in the municipality Final: Focus on 17 water sources that were considered most important	-semi-structured group interviews -measurements at the water sources -start of cooperation with local universities (UCA and UES)	-Collection of existing base data ⁹ -primary data collected at 17 water sources regarding type, administration, supplied villages, discharge, water temperature, conductivity, pH and others -integration of the data in a local QGIS at the alcaldía	-In theory, all water sources should provide sufficient water for its respective users. However, users were often faced with water scarcity. -More all-encompassing and routine data collection and training of alcaldía staff in the usage of the created GIS are necessary.
Rossmann (2017) Further development of the Water Information System in the Municipality of Tecoluca, El Salvador	February – June 2016	Broadening of existing data base and making it accessible globally via a WebGIS-application	-taking of new measurements at the water sources together with Liemberger (2018) -unification of the data in a PostgreSQL created by him and UCA students -creation of WebGIS browser application 'WIS Tecoluca' -creation of user manual and training of selected alcaldía personnel	-Tecolucan WIS now accessible under the URL http://216.184.100.195/sig_tecoluca/	-WIS now globally accessible -For the future: broadening and routine actualization of the WIS; increased user friendliness via the installation of a content management system

⁹ The main existing data is referred to as the '2015 Census by MINSAL' in Schaidreiter's thesis as well as in the following theses. Also in the interview with her, that formed part of this thesis, she explained it as such. However, the last official census of El Salvador was conducted in 2012 (MINEC, 2019). As well, the alcaldía itself only conducts local censuses in villages where projects are about to take place. Rather, the used data in all likelihood presents a regional summary of MINSAL's *Ficha Familiar* [family report], which is recollected annually.

<p>Liemberger (2018) Investigation of Water Resources in the Municipality of Tecoluca and Evaluation of Water Supply in El Milagro, El Salvador</p>	<p>February – June 2016</p>	<p>Original: cooperate with UCA students in the creation of automatized water source data collection tools (Liemberger, 2019)</p> <p>Final: Retaking of measures made by Schaidreiter (2016), case study on drinking water situation in the village of El Milagro, Tecoluca</p>	<p>-taking of new measurements at the water sources together with Rossmann (2018)</p> <p>-transect walks</p> <p>-structured interviews</p> <p>-quantitative evaluation of El Milagro's water supply via water meter readings, pressure data and available data on the network infrastructure</p>	<p>-primary data retaken where Schaidreiter had taken measurements</p> <p>-regarding El Milagro:</p> <p>--relatively high average water consumption considering few access points per household</p> <p>--network sub-optimally designed and badly maintained</p>	<p>-Again: for all water sources, the amount of available water should theoretically suffice for all connected users, but users experienced water scarcity.</p> <p>-Also the case for El Milagro. Possible reasons for the scarcity mentioned left</p> <p>-For the future: calculation of a water balance for El Milagro to determine water loss and detect leakages</p>
<p>Lasser (2018) Concepts for continuous discharge measurements and planning of water allocation in the communities of El Milagro and San Francisco Angulo</p>	<p>June – December 2016</p>	<p>Original: continue Liemberger's work in cooperation with UCA (Lasser, 2019)</p> <p>Final: Basic research on the installation of a tool for continuous spring discharge measurement at El Milagro's spring capture; case study on El Milagro's and San Francisco Angulo's drinking water situation</p>	<p>-literature review on the topic of continuous spring discharge measurement</p> <p>-household surveys in the villages of El Milagro and San Francisco Angulo in cooperation with Schütz (2018) and others</p>	<p>-comparison of several continuous spring discharge measurement equipments using several criteria</p> <p>-household level data on El Milagro's and San Francisco Angulo's water availability and consumption</p>	<p>-low water availability at household level</p> <p>-For the future: calculation of water balances for the two villages; training of qualified alcaldía personnel in data management</p>
<p>Kern (2018) Hydraulic water balance calculation and water quality analysis of the drinking water supply system of San Francisco Angulo and Cantarrana, El Salvador</p>	<p>5 months in 2017</p>	<p>Calculation and modelling of hydraulic water balance for the water supply system of San Francisco Angulo and Cantarrana</p>	<p>-data collection in cooperation with the villages' responsible for the maintenance of the water pumps</p> <p>-evaluation of water quality (regarding chlorine contents)</p>	<p>-amount of Non-Revenue Water: 11.877m³ p.a. (35% of water that enters the system)</p> <p>-amount of Real Water Losses: 8.401m³ p.a. (24%)</p> <p>-running of 4 scenarios in EPANET</p> <p>-modelling of water losses in EPANET not possible</p>	<p>-significant water losses in the system</p> <p>-current chlorination strategy insufficient</p> <p>-For the future: better data management at the alcaldía, amplification of the cooperation between BOKU and UCA/UES</p>

Fundamentals

			-failed cooperation in this with UCA [sic] ¹⁰ -integration of data into an EPANET model -calculation of Non-Revenue Water		
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Table 3 Studies conducted by BOKU students on Tecoluca's sanitary situation

Author (Year) Title	Stay in Tecoluca	Objective	Methods	Selected Results	Selected Conclusions
Biber (2016) Investigation of the Sanitary Situation in Tecoluca	March - July 2015	Collect and create basic information on Tecoluca's sanitary situation -collect it locally at the alcaldía in a GIS -form connections with local universities	-semi-structured interviews with one member of 15 of Tecoluca's rural communities -structured surveys with 5 households in each of Tecoluca center's 6 zones -main data source: 2015 Census of Tecoluca [sic]	-Collection of existing base data -incorporation of it into the GIS	-84% of households have access to an improved sanitation system under JMP classifications. 58% of households have compost latrines, 27% use pit latrines, 8% have toilets with flushing and 7% use toilets with pits -87% of rural interviewees state that grey water is discharged onto the street and 45% of urban interviewees would be willing to pay grey water tax of 2-3\$/month -For the future: more detailed data collection in rural Tecoluca, training of alcaldía staff in the use of the GIS, and a feasibility study on sanitation alternatives in Tecoluca center

¹⁰ In her thesis, Kern names the UCA as the (failed) cooperation partner for the measuring of topographical data. However, the contact persons at UCA renounce all knowledge of her investigation and her person. On the other hand, the contact person at UES in San Vicente does mention having carried out several topographical studies for Austrian students. Also, Kern mentions the „UCA“'s seat in San Vicente. The UCA does not have such a seat in San Vicente, but the UES does. So, it is very probable that Kern was really in contact with UES, not UCA.

Fundamentals

Schütz (2018) Evaluation of the sanitary situation in the communities of El Milagro and San Francisco Angulo, El Salvador	September – December 2016	Detailed evaluation of the sanitary situation of the villages of El Milagro and San Francisco Angulo, Tecoluca	-household surveys on El Milagro's and San Francisco Angulo's sanitary situation	-household level data on El Milagro's and San Francisco Angulo's sanitary situation, containing type of sanitation system, availability of handwashing facilities, treatment of grey water and solid waste -Shit Flow Diagrams for the two villages	-26% of households in El Milagro and 9% in San Francisco Angulo have access to a safely managed sanitation service -39% of secreta in El Milagro and 27% in San Francisco Angulo are disposed of safely -Grey water runs off in the street, solid waste is burned -For the future: study sanitary situation of the rest of Tecoluca's rural villages; regularly actualize WIS; expansion of cooperation between universities
Döber (2018) Adaption of a Simplified Planning Tool for El Salvador	5 months in 2017	Adapt the sanitation part of CLARA SPT tool created in the EU project <i>Capacity-linked water supply and sanitation improvement for Africa's peri-urban and Rural Areas</i> lead by Langergraber to El Salvadorian conditions ¹¹	-collect normative and cost data regarding sanitation systems via semi-structured interviews and the use of relevant national frameworks	-gathering of necessary data for the cost calculation for El Salvador, which was then integrated into the SPT tool	-Different national standard values for the amount of wastewater and pollution loads increased the calculated costs -For the future: necessity of a regulatory framework. Tool would probably have to be recalibrated, when this is created.
Wiesmair (in progress) Assessment of the sanitary situation of rural communities in the Bajo Lempa region and its implications for sustainable sanitation planning in the municipality of	October 2018 – March 2019 Thesis still in progress, information taken from the interview	Original: assess the sanitary situation of all of Tecoluca's villages by giving a central role to alcaldía personnel Final: assess the sanitary situation of 5 villages in Tecoluca's Bajo Lempa region by giving a central role to personnel of the region's health center and	-training of selected village members in the realization of surveys based on Schütz (2018) in their villages -visitation of the selected households' latrines with the local health promoters to register their actual	To be published	To be published

¹¹ The CLARA SPT is a planning tool for the cost calculation of different water and sanitation infrastructure alternatives that was created to facilitate the selection of investment alternatives.

Fundamentals

Tecoluca, El Salvador (working title)	with Wiesmair (2019)	members of the investigated villages	(and not only stated) condition		
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3.4 Evaluation and Impact Assessment in Development Cooperation

In this subchapter, the analytical approach used in this thesis will be shortly introduced:

As has been mentioned in Chapter 1, the routine evaluation and assessment of development cooperation projects and programs is considered good practice and provides the opportunity to make necessary course corrections (OECD DAC 1991).

The state of the art is to follow the OECD's Development Assistance Committee (DAC)'s Criteria for Evaluating Development Assistance (OECD DAC 2019). The proposed criteria are:

- **Relevance:** Is the aid activity suited to the priorities and policies of the target group?
- **Effectiveness:** To what extent does the aid activity attain its objectives?
- **Efficiency:** How do outputs of a program/projects relate to the inputs (quantitatively and qualitatively)?
- **Impact:** What are positive and negative changes produced by a development intervention (directly or indirectly, intended or unintended)?
- **Sustainability:** Are the benefits of an activity likely to continue after donor funding has been withdrawn?

As this list shows, detailed and quantified information on the 'aid activity's' inputs and outputs are necessary to answer most of these questions.

Another type of assessment for a policy or 'aid activity' is the 'impact assessment'. Following the OECD's definition of 'Impact Assessment' (OECD, s.a.), the 'impact assessment' focuses on the effects of an intervention instead of a wider range of issues as is the case with evaluations.

The approach chosen for this thesis is presented in 4.1.

4. Material and methods

4.1 Analytical framework

In 3.4, two types of assessment of policies and 'aid activities' were presented. It became clear that detailed and quantifiable information on the 'aid activity's inputs and outputs are necessary to conduct an evaluation.

In this thesis, the 'aid activity' in question is a research program consisting strictly of master theses. Also, a time lapse has occurred between the realization of most of these theses and this present impact assessment. These facts make the finding and quantification of inputs and outputs difficult. For this reason, it was decided that a full evaluation following OECD DAC criteria in itself would not fulfil the OECD DAC's criterion of efficiency. Rather, the approach of a more informal 'impact assessment' was chosen.

Thus, a focus is taken on the research program's effects instead of other, deeper lying issues. To still be able to depict a broader range of topics, it was decided to also present the challenges experienced by students and recommendations given by key stakeholders.

Output, Impact, and applied indicators

Knöpfel et.al. (1997, p.100-103) defined Output and Impact as following:

- 'Outputs' are the products of a program, i.e. 'what was produced in its course?'. In the context of this assessment, the outputs of the research program would be the finished theses, the tools that were created/contributed to, manuals, data catalogues that were delivered to villages, trainings and presentations that were held and so on.
- 'Impacts' on the other hand refer to the real effects that a program causes in its target group. That is to say, in which way and to which amount did a policy or program lead to a change in conduct?

It is not sufficient to find and depict positive changes in the target group's behaviour. However, for a change in the target group's behaviour to be an impact of the evaluated program, it must also be caused by the program's output.

Again, it becomes clear that finding direct impacts of the research program, that are proven results of it, would be highly cost- and time-sensitive.

Thus, a short-cut was taken yet again. Instead of determining the real impacts of the research program, the level of which key co-operators and stakeholders knew about BOKU research results and tools and self-reported instances of usage of them were used as indicators for the research program's impact.

In Chapter 5.2, a differentiation is made between 'hard' use and 'soft' use. The term 'hard use' is used to refer to actual use of IT tools, as well as policy decisions made aided by BOKU results and tools. The term 'soft use' is used to refer to instances where interviewed stakeholders reported that they 'had learned something' or 'had found it interesting.

4.2 Basic Information Search

Of course, literature research forms the backbone of this master's thesis. Detailed studies on the El Salvadorian WASH sector were necessary for basic understanding as well as on the previous master theses themselves.

4.3 Interviews

Qualitative semi-structured personal and group interviews were chosen as the tool most apt to answer the formulated research questions. This is due to the fact that semi-structured interviews enable the interviewer to guide the conversation while at the same time allowing the interviewees to set their own foci and give detailed background information. (Wirtzens et.al., 2017)

The interviews were conducted in the following manner:

4.3.1 Conceptual Stakeholder Map and Selection of interview partners

As a basis, it was decided to answer the question “Who are relevant stakeholders in Tecolucan WASH governance and research?” To try and answer this broad question, it was decided to draw a 'Conceptual Stakeholder Map' with the help of local cooperation partners (Herberth Sanabria from the alcaldía of Tecoluca, and Aida Sandoval, doctor at a local health unit).

This conceptual stakeholder map, of which a simplified version can be found in the Appendix (Chapter 10.5), was designed as a matrix between the classical sectors of governance after Steurer (2013) (government, NGOs and private actors; the sector of universities was added due to characteristics of the research questions) and spatial levels (international, national, supra-regional, regional [departmental], municipal, supra-communal, and local [communal]).

An attempt was made to fill all these categories as completely as possible in order to create as complete a picture as possible.

Based on this map, the interview partners (and groups of interview partners) were selected trying to answer the following two questions:

- *Who and which institutions and functionaries had cooperated with BOKU students in previous theses?*

This was estimated based on mentions in previous theses and verbal mentions by one of the three main cooperation partners (the alcaldía of Tecoluca, INTERSOL and BOKU).

Virtually all specifically mentioned previous cooperation partners (and/or those currently in their respective roles) were interviewed. In cases where many potential interviewees in the same role existed (such as the interviewers in Wiesmair's study (Wiesmair, in progress), where there were around 20), selections were made to reduce the number of interviews. In the mentioned example, it was attempted to interview at least one for each of the 5 participating communities.

The time lapse in between the theses and this assessment of course hindered this. Intermittent changes in political administration and other personnel changes, as well as the fact that researchers and other cooperation partners could not always recall all interactions of cooperation and corresponding institutions/names made finding all relevant cooperation partners for all theses difficult.

- *Who are the most important stakeholders in Tecoluca's WASH governance scene? Have any of them not yet been part of a cooperation with BOKU? If yes, which ones and why have they been left out?*

This criterion of 'importance' was of course difficult to define and basically it was tried to crystallize those stakeholders that were mentioned most frequently in laws, regulations and such and by other stakeholders.

Thus, it was tried to use a snowball system and incorporate feedback loops in the creation of the conceptual map. When interviewed stakeholders could give insights into the workings of local WASH governance or mentioned not yet recorded stakeholders, the conceptual map was updated.

This second defining question was used as an addition to the first one to prevent the possibility that theoretical key WASH stakeholders who would have been left out in previous works would still be left out in this review and thus remain undetected.

This process of course only served to determine the local interview partners in Tecoluca, but not key stakeholders of the research program in Austria. To depict the opinions of key stakeholders from the BOKU side, all the former master students were interviewed.

It was decided that the Austrian organizers of the research program (them being the thesis supervisors and the director of INTERSOL) would not be formally interviewed. The reason for this is that the information gathered in this thesis should serve as a basis for evaluation to them, and they after all know their own opinions on the matter. However, it must be noted that for external readers, the exclusion of their opinions from this thesis will of course distort the results.

4.3.2 Interview Guide

A very broad 'master interview guide' was created that contained questions relating to all research questions and applying to all possible types of interview partners (BOKU students, water boards/committees and ADESCOs of cooperating communities, alcaldía personnel, representatives of other relevant government agencies at different levels, representatives of cooperating universities, students of cooperating universities, NGO representatives, representatives of private firms). For this, guidelines for interview guide creation presented by Scherhauser & Nordbeck (2018) were followed.

This 'master guide' can be found in Spanish in the Appendix (Chapter).

For each type of interview partner, an updated interview guide was created by selecting pertaining questions from the 'master guide'.

Additionally, the respective interview guides and the 'master guide' were continuously updated as new knowledge about the topic and the usefulness of the guide itself was gathered in its application.

4.3.3 'Trial runs'

It is of course part of good scientific practice to conduct trial runs for one's interviews. However, real 'trial runs', where the interview guide is tried out with related, but differing, populaces, was not possible due to the characteristics of the research questions: After all, the objective was to find out very specific information regarding the research cooperation from all relevant WASH governance stakeholders in Tecoluca. So, to have any idea about the research cooperation or WASH in Tecoluca, the interviewees had to be part of Tecoluca's WASH governance and/or research sector.

This is to say that a 'related, but differing populace' with which to conduct trial-runs did not exist.

However, to still give validity to the guide and the interviews, it was attempted to start the interviewing process with the interview partners that were considered less central to the question and WASH in Tecoluca, such as higher-up MINSAL and MIGOBTD representatives, students of cooperating universities, and representatives of private firms. An attempt was made to schedule interviews for interview partners that were considered most critical to the questions, such as communal water boards/committees and ADESCOs, master's thesis students, and alcaldía representatives and personnel for a later date, when the author could count with more experience and a more refined interview guide.

It was not always possible to follow this hierarchy due to, for one, scheduling conflicts, and for another, the fact that a snowball system was used. After all, interview persons that were considered critical could mention additional stakeholders that were less central but who would still be interviewed in the end.

For the case of alcaldía personnel, who were considered an important source of basic information as well as key cooperation partners (i.e. the head of the office of international relations, the head of

the environmental office, and the 'water judge'), interviews with a broader focus were conducted early on and follow-up interviews to answer open questions were conducted at a later date.

All interviews were recorded for later analysis.

Following these steps, 54 interviews have been conducted with a duration ranging from 10 minutes to up to 2 hours.

4.4 Data Analysis

The recorded interviews were transcribed manually and coded in MAXQDA. The coding scheme was derived directly from the needs of the research questions and also inductively from the material. Good practice for qualitative content analysis, as presented by Mayring (2000), was followed.

The material was grouped and analysed differently for different research questions. The respective research questions are the following:

- Q1) What difficulties did students encounter in their research?
- Q2) How well-known and used are created tools and results?
- Q2.1) What hindered their usage?
- Q3) What proposals and recommendations do key stakeholders have for the future of the program?

For the recommendations (Q3), the interviewees were grouped by the type of interviewee (students, alcaldía members, representatives of local cooperating universities, representatives of cooperating villages, and others¹²).

In the case of Q1, the students are the only interviewees for which this question applies and thus the only ones considered to answer it.

In order to determine the level of knowledge about and usage of created results and tools (Q2-2.1), the 9 master theses were split in three thematic groups. In each of them, the level of knowledge about/usage of the tools/results of cooperators, who had cooperated in this specific thematic group were analysed. They were chosen based on their cooperation being known or mentioned in the relevant theses, and by those respondent's referrals to other people they considered 'key stakeholders' for the topic. The groups and corresponding interviewees are:

- **Group WIS**
 - This group includes the three master's students who were working directly on Tecoluca's Water Information System (WIS), which is a web-based geographic information system containing data on Tecoluca's WASH situation. The relevant theses are Schaidreiter (2016), Biber (2016), Rossmann (2017).
 - Included interviewees (27 interviews):
 - BOKU: the three students, as well as one additional student, who contributed data to the WIS but took a focus in their master's thesis on a Community Diagnostic (interview only partially included, where the student spoke about the WIS, and not on her core topic)
 - alcaldía: the head of the cooperations office and contact person for the BOKU research program, the mayor, the municipal council (as a group and one interview

¹² This group contains representatives of local government institutions other from the alcaldía and representatives of NGOs working in WASH in Tecoluca

with a representative), the 'water judge', the responsible for IT, the assistant to the manager, a member of the communications unit, the alcaldía's cadastre unit (as a group), the alcaldía's responsible for civil protection and disaster response, the head for the citizen participation unit, the head of the environmental unit, an architect who is a member of the planning unit;

- former alcaldía members (who cooperated in the project during their time there): the former mayor, the ex-responsible for IT, the former responsible for IT education;
- local universities: the contact person for the cooperation with UES (Universidad de El Salvador, Sede Paracentral, San Vicente), a UES student working on a water GIS for the environmental office during a practicum, the contact person for the cooperation with UCA (Universidad Centroamericana Simeón Cañas);
- government agencies: MINSAL: health inspector of central Tecoluca, ANDA: responsible for their systems in the San Vicente region;
- NGOs: current president of ADCLA (Asociación de Desarrollo Comunitario Lempa Abajo);

- **Group Community Diagnostics:**

- This group encompasses all master's students who analyzed in detail the sanitary or water supply situation of specific villages within Tecoluca. The corresponding theses are Liemberger (2018), Schütz (2018), Lasser (2018) Kern (2017) and Wiesmair (in progress).
- Included interviewees (31 interviews):
 - BOKU: the five students
 - alcaldía: the head of the cooperations office and contact person for the BOKU research program, the mayor, the municipal council (as a group and one interview with a representative), the 'water judge', the social promoter for the Bajo Lempa region;
 - former alcaldía members (who cooperated in the project during their time there): the former mayor;
 - villages: water board of Cantarrana (as a group), El Milagro (general assembly and water board, both as a group, one village council member and former cooperator), San Francisco Angulo (general assembly and water board, both as a group, one former water board member and former cooperator), Isla Montecristo (representative of the village council), El Naranjo (village council, as a group), La Pita (village council, as a group), Nueva Concepción (village council, as a group), Puerto Nuevo (village council, as a group), Santa Marta (village council, as a group);
 - local universities: the contact person for the cooperation with UES (Universidad de El Salvador, Sede Paracentral, San Vicente), the contact person for the cooperation with UCA (Universidad Centroamericana Simeón Cañas);
 - government agencies: MINSAL: health inspector of central Tecoluca, the two health promoters for Santa Marta (as a group);
 - NGOs: project director of the Red Cross for San Vicente, Living Water (responsible for their projects in Tecoluca);
 - companies: architect for Enersys (company that runs a solar park in El Milagro and has funded some of their projects, also in water infrastructure);

- **Group SPT**

- This 'group' includes only one master student so far (Döber, 2018). CLARA SPT refers to a Simplified Planning Tool that was created in the project CLARA led by BOKU and is a xls-tool that calculated costs of different water and sanitation investment alternatives (Langergraber, et al., 2014; Döber, 2018). Döber adapted the standards and cost functions for the sanitation part of the tool to El Salvadorian conditions. The next thesis in this group will focus on the water part.
- Included interviewees (6 interviews):
 - BOKU: the student
 - alcaldía: the head of the cooperations office and contact person for the BOKU research program, the mayor, the municipal council (as a group and one interview with a representative), an architect who is a member of the planning unit;
 - former alcaldía members (who cooperated in the project during their time there): One architect from the planning unit was mentioned by Döber as one of his main cooperation partners. Unfortunately, this architect could not be found. Thus, the interview material in this group lacks one central participant.

As can be seen, some interviewees are considered key stakeholders in two or all three groups. This is the case when they have played central roles in the creation of more than one group's master's theses.

The interviewee groups' opinions were analyzed for the following aspects:

- Knowledge about the results and tools
- Usage of them
 - divided into 'hard' and 'soft' use, with 'hard' use referring to applications of the results in planning decisions or administrative routines
 - and 'soft' use referring to the learning of 'soft skills', such as 'having learned something' or 'having found it interesting'.
 - Stumbling blocks that hindered usage

For the research questions on challenges experienced by students and recommendations given, the coding emerged internally from the types of challenges or recommendations that had been recounted.

In this master's thesis, the results are presented mostly in an aggregated manner. Where direct quotes from the interviews are used to illustrate aggregated results, the formatting of the quotes clearly signalizes them as direct quotes:

"They are written in brackets, in cursive, using Arial pt. 10 and indented by 1cm."

Additionally, the author of the quote is indicated using the following coding system to maintain anonymity:

They are differentiated by the type of interviewee (student, alcaldía member, village representative, university representative, NGO, government), and within these groups numbered by their interview date.

Thus, a student, whose interview had been the third one among students, would be indicated as Student 3.

As this thesis is in English, and all interviews were conducted either in Spanish or in German, the quotes presented here are translated into English.

5 Results

5.1 Difficulties in the research process

In this chapter, we try to describe challenges students were faced with during their field research based on answers given to Q1.

To answer this, the nine students have been interviewed. Regarding Q1, the answers could be classified into seven categories. These categories are shown in Table 4, as well as the number of students who were faced with these challenges and the number of times each of them was mentioned:

Table 4 Encountered difficulties in the research process, by students mentioning them and by mentioned frequency

Aspect	No. of students	% of students	No. of mentions	% of mentions
Interface of thesis work and project work	9	100	46	19
Contextual challenges in Tecolucan WASH governance (not specific to the research)	9	100	42	17
Cooperation	8	89	60	25
Organization by BOKU/students	8	89	53	22
Organization by the alcaldía	7	78	21	9
Financial aspects	5	56	20	8
Total of students who encountered at least one of these difficulties	9	100	-	-
No. of coded segments	-	-	243	100

5.1.1 Ethical challenges at the interface of research and project work

Table 1 shows that all nine students faced **challenges that arise at the interface of conducting their research and being part of a project of development cooperation** (code C2.3). Seven students bemoaned that they could not fulfil their own or other people's expectations regarding the impacts of their work. Six of them felt that their results lacked applicability in the realities of their cooperators and other people. Five had difficulties discerning the overall goal of the research program and four felt that they lacked expertise when conducting their research. Other aspects that fall under 'ethical challenges' were mentioned as well by two or one student(s) each.

To illustrate the broad term of 'ethical challenges', a few examples will be presented:

One example for '*Lowering people's expectations*' was given by Student 2:

"[It was necessary to] Lower expectations [of the interviewed people]. And I often felt this way and didn't know how to deal with it. Because often, [our cooperators] would conduct the interviews and I wasn't always present. [...] And I did find out that one said, like: 'Yeah, we're doing something with this data to better the [WASH] situation and so on.' And this implies something that we don't fulfil. But I also didn't want to interrupt them and say: 'No, this is nonsense'."

The following quote by Student 7 serves as an example of the category '*Lack of applicability of results*':

"Looking at it today, I maybe would have focused more on the implementation. So maybe I would have done less and neglected the [software related] stuff and dealt more with the implementation. So that in the end, something would really come out of it instead of only data."

And one prime example for the category 'Searching for the meaning in the research program' is the following one:

"I don't really know what the aim is, to a part. Yes, data and data, but what is the aim of the data?"
(Student 5)

5.1.2 Contextual challenges in Tecolucan WASH governance

Again, all students experienced challenges that could be categorized as **general challenges within the Tecolucan WASH sector that were not specific to the respective research**.

Six students were faced with a lack of baseline data for their research.

Five felt that WASH governance wasn't sufficiently integrated at alcaldía and/or community levels. That is to say that at relevant institutions, there were only very few experts on the topic and that there often was a lack of coordination within and between institutions.

One example for this at alcaldía level is the following:

"At first, I asked [the head of the alcaldía's cooperations office], how many or which NGOs or projects on WASH there were in the municipality. And he told me that there were so many he couldn't even say." (Student 5)

At community level, Student 2 gives an example:

"I cooperated mainly with the man who was responsible for the operation of the pumps [of the village's water system]. [...] He was the only one who knew about this. And it would be necessary to show more people how to operate the pumps."

Four students found that interpersonal or political rivalries were hindrances in their work.

The category of 'contextual challenges' will not be analyzed in more detail as it is the one that would be most difficult to influence.

5.1.3 Challenges in Cooperation

When looking back to Table 1, one can see that eight out of nine students faced challenges when cooperating with other people, be that representatives of local universities, members of village councils and/or committees or representatives of government institutions.

It is also notable that even though not all students experienced challenges in this category, it was the category that was most frequently mentioned. This seems to indicate that for those who did face challenges in the cooperation with others, these challenges were those that most frequently impacted their work.

Figure 3 shows how many students faced challenges that fall under the category '**Challenges in Cooperation**':

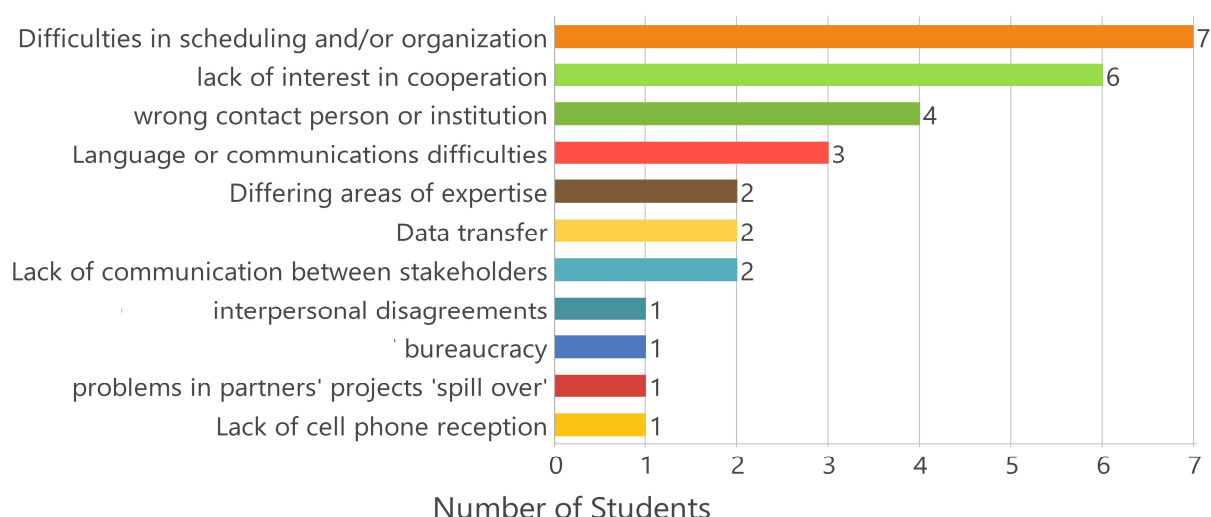


Figure 3 Challenges in the cooperation with others by number of students who experienced them

This shows that the most frequent challenge in the cooperation with others was in scheduling or other organizational aspects.

6 students also felt that there was a lack of interest in cooperating with them by some stakeholders. Student 6 and Student 3 both experienced this when they tried to cooperate with higher up government agencies but could not receive a sufficient response.

This is of course unsurprising and explains why this category was the second most mentioned. However, there were also 4 instances where students felt a lack of interest in the cooperation by close cooperation partners, such as alcaldía staff or students from other universities.

This may also be connected to the following category that was mentioned by 4 students: They felt that they (in some instances) were cooperating with the wrong people or the wrong institutions. This would of course explain why these cooperation partners then feel a lack of interest in the cooperation.

Another aspect that was experienced by 3 students was the language barrier or other types of miscommunication.

5.1.4 Organization by BOKU and/or students

When looking again at Table 4, one can see that also this category was experienced by eight out of nine students, so it seems that one student didn't face any challenges in this aspect. However, similarly as in the previous category, this category was mentioned very frequently. In fact, it is the second leading category by mentions.

This category refers to **challenges that arose in the organization of the research program by the university itself, the project supervisors or the students themselves.**

In Figure 4, the different subcategories in this category are presented by frequency of mentions:

Results

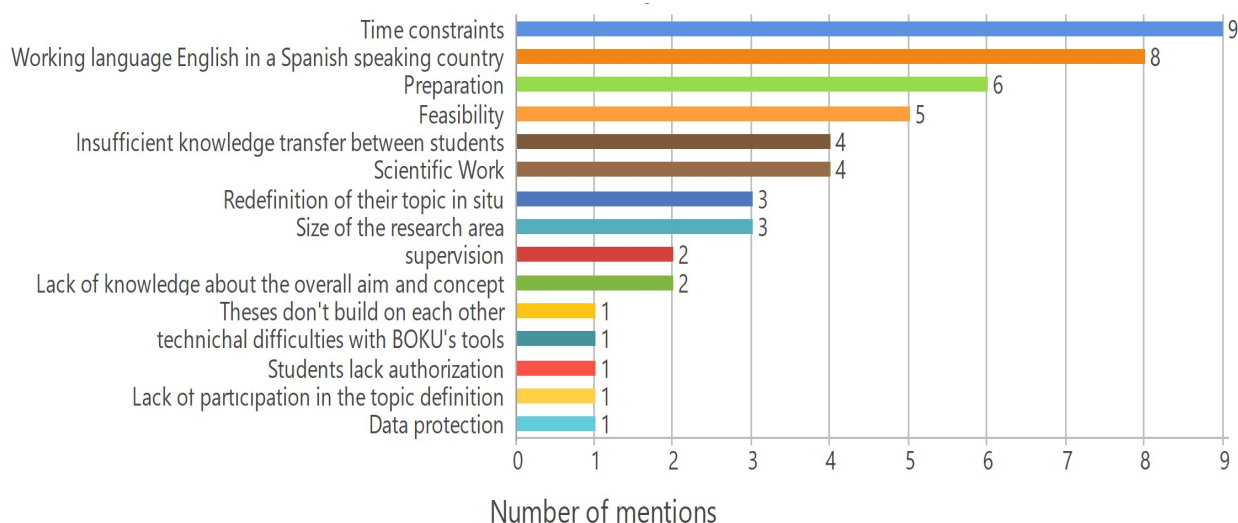


Figure 4 Challenges in organization by BOKU and/or students by frequency of mention

As Figure 4 shows, with most mentions is ‘*Time constraints*’ and refers to the overall time the students spend in El Salvador, which is of course limited. The second leading one is ‘*Working language English in a Spanish speaking country.*’

The category with third most mentions is ‘*Preparation*’. This is to say that it was mentioned six times that students would wish for a more in-depth preparation before leaving for Tecoluca. As responsible parties for this preparation, they see the university, their supervisors and themselves. Two specific aspects, on which they wish more preparation are ‘ethical challenges’ and ‘feasibility’ of planned studies. The following quote by Student 9 thus will also bridge the gap towards the category with fourth most mentions, ‘*Feasibility*’:

“I would do much more work in the run-up, especially regarding organization. Define beforehand, what the topic, the task is, what are the things that you need for that. Simply to clarify whether these things are possible [...]. Just so that you can say, before you leave, OK, this works or it doesn’t.”

‘*Feasibility*’ refers to whether it is possible to realize the planned research project in the allotted time and with the allotted resources. 5 students experienced difficulties in this aspect.

To deal with this issue, some students applied an approach where they started off with smaller projects which they then broadened. Others, on the other hand, had more ambitious goals which they then had to reduce.

One example for the latter was experienced by Student 4:

“Well I have to say that the initial goal of my master’s thesis was more ambitious than it turned out in the end. Reasons were, for one, that I lacked experience, that the people there do things... a little more unhurriedly than us Austrians, let’s say. And also that these things take time and so we couldn’t finish what we had planned in the beginning.”

On the other hand, Student 6, who worked together with Student 4, had the following experience:

“I have to say that I didn’t have any expectations [towards what I wanted to achieve]. We had this task and realized it on our own. This was good because we could see on-site what was possible and what was not. And I do think that I achieved what was possible.”

These two students were in Tecoluca at the same time and worked on adjacent topics. This seems to show that whether the aspect of 'Feasibility' proves a difficulty mostly depends on perspective.

5.1.5 Organization by the alcaldía

This category refers to **organizational aspects that proved challenging for students that fell under the responsibility of the alcaldía.**

Table 4 shows that this category is the second least frequent, both by the number of students who mentioned it as well as by number of times it was mentioned.

In the following Table 5, the challenges that fall under this umbrella term are presented by number of students who experienced them:

Table 5 Organizational challenges that fall under the alcaldía's responsibility, by number of students

Aspect	No. of students	% of students
Lack of infrastructure or capacity (technical and human)	5	71
Lack of preparation by the alcaldía	3	43
Lack of interest in the cooperation	3	43
Transport	2	29
Lack of support	1	14
Only one contact person at alcaldía	1	14
Number of students experiencing challenges with alcaldía organization	6	100

The first subcategory here, '*Lack of infrastructure or capacity*', refers mostly to technical challenges such as slow internet but also lack of employees (or their time) for additional work.

The second category, '*Lack of preparation by the alcaldía*' was experienced by three students and they either feel that they don't know the alcaldía's overall aim for the cooperation or that the alcaldía didn't quite know what the students needed for their work.

In this category, one has to be careful, because the third most mentioned one is '*alcaldía's lack of interest in the cooperation*', experienced by two students. However, at the same time 7 people praised the alcaldía's high interest and passion for the involvement. The high amount of positive support however isn't visible when only looking at challenges, as is done in this thesis. This shows the risks of an approach focusing on challenges.

So, for once, we will look deeper into the opinions of those praising the alcaldía's involvement. Virtually all named the alcaldía's head of the cooperations office as their main contact person and when they were talking about the alcaldía's high interest, they mainly referred to him, as is highlighted by a statement by Student 3:

"The biggest support for this was [the head of the cooperations office], naturally. Without [him], I think it wouldn't have been possible. [...] I think that was the case for all students."

Looking again at those two students who experienced a lack of interest in their work from the alcaldía, they were referring to the alcaldía as a whole or at least more persons, not the head of the cooperations office specifically.

5.1.6 Financial Aspects

This category is the last one in Table 4. This cost constraint was felt by 5 out of 9 students. Each of these felt that the lack of funds for follow-up investments to their research detracted from the impact of their works.

The importance of this aspect will be discussed further in Chapter 5.3 (Visions and Recommendations for the future) because all 9 students gave the recommendation to make follow-up investments in the future.

5.2 Knowledge and Usage of created results and tools

While Chapter 0 took a look at students' experiences during their work in Tecoluca, in this chapter we will try to determine the outcomes of their research in Tecoluca. This we will approximate by answering research question Q2:

Q2) How well-known and used are created tools and results?

Q2.1) What hindered their usage?

To answer these questions, the 9 master theses were split into three thematic groups, as is explained in more detail in 4.4. In the three groups 'WIS', 'Community Diagnostics' and 'SPT', 26, 31 and 6 interviews were held respectively.

5.2.1 Group WIS

For the WIS, first Schaidreiter (2016) and Biber (2016) collected quantitative and qualitative data on the drinking water and sanitary situation of 17 villages/drinking water systems and Tecoluca town.

They integrated it into a GIS, which was later broadened by Rossmann (2017) and Liemberger (2018). Rossmann, with the help of UCA students, then unified the data in a PostgreSQL database and created a web application for it. He also held a workshop for designated administrators and editing users of the tool.

The original plan for Liemberger's thesis was to also collaborate closely with UCA students in the creation of a device that would automatically transmit quantity and quality data of a spring capture's discharge. This had to be abandoned and she changed her approach to that of the 'community diagnostics' (see Table 2).

5.2.1.1 Knowledge and Usage of the WIS

For the interviewed people presented in Chapter 4.4 (Group Diagnostics), their level of knowledge about the tool is the following:

12 people out of 27 interviews (one of them being a group interview, so there were more than one person present¹³) said that they knew about the tool. Among these, four of them were students who had collaborated in its creation. Another 2 claimed to know them but this didn't seem to be the case in reality:

Both the actual mayor as well as the interviewed representative of the municipal council mentioned that they knew about the WIS and had received a presentation on it a few months prior by the alcaldía's environmental unit.

13 This group interview was held with the village council. One councilor, who had been part of the council also at the time the WIS was created, claimed knowledge about the tool.

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The members of the environmental unit, however, did not know about the WIS created by BOKU, but rather were in the process of collecting water related data (regarding river dams for irrigation) in their own independent GIS.

So, not only did the alcaldía's environmental unit not know about the WIS but also the mayor and the interviewed representative of the council did not really know what the WIS was.

Taking this fact into account, one can say that in 26 interviews, 10 people could be found who knew about the tool.

To start of the topic of 'usage of the tool', the following quote of Student 6, who was one of the original creators of the WIS, will be presented:

"I didn't have the expectation that, if I came back now after five years, that the WIS would be working. I didn't have these expectations and I didn't leave with them."

In order to check whether this prediction has proven true or not, we will first look at those who had received a training of its usage and held administrative and editing rights to the tool. All three of them stated that the workshop they had received had been very interesting for them personally, but they never used the WIS again after that.

All three stated that the tool was interesting and potentially very useful. Two said that the workshop was too short regarding their educational background for them to be actually able to use it. All three of them stated that they had not been the right people to receive the administrative/editing rights to the tool.

All three students also mentioned the fact that the administration, editing or use of the tool had never been assigned to them as an official work task by their superiors caused them to never use it again.

Additionally, the person who had received administrative rights is not employed by the alcaldía any longer.

Considering this fact that those who had received training and admin/editing rights to the tool didn't feel they were the right persons for the task, their (and other alcaldía staff's) recommendations on who should be administrators, editors and users were taken into account. They identified that the alcaldía's IT unit, environmental unit, planning unit, civil protection unit and cooperations unit were the units for which the tool would be most useful and who should have a leading role in its use.

Representatives of these units were interviewed regarding the WIS and a workshop was held. All 7 of them found the tool highly interesting and very useful for them in their day to day work.

One example for this was given by the representative of the planning unit, Alcaldía 12:

"This tool would be really helpful for me, because I would only have to click on each village to know its population. Right now, I have to hold a census [in the concerning village] for each time that I write a project draft."

This shows that even a GIS that contains basic demographic data could be really helpful for some of the alcaldía staff.

The result of this workshop was that the tool was highly useful if it contained even very basic information, but that a political commitment and official work assignment by the municipal council is necessary in the first place.

In the following Table 6, the level of knowledge about the tool and instances of 'hard' and 'soft' use that were briefly described above will be resumed:

Table 6 Knowledge about and usage of the WIS (resume)

Knowledge about it	Instances of ,actual hard use‘	Possible future ,hard use‘	Instances of ,soft use‘
10 out of 26 interviews knew about it (including 4 students)	No instances of ,actual hard use‘ (use of the tool, decisions based on it) occurred	9 people didn't know about the tool but found it highly interesting and useful for the future (7 of them alcaldía staff)	One of those who had received training said it had been very educational for her personally
2 claimed to know but referred to other GIS		Political commitment was demanded but has not been given yet	One of the students said that her work mostly impacted her cooperators via awareness-raising
14 didn't know			

5.2.1.2 Stumbling blocks

Now, we will look into people's opinions on what hindered the usage of the tool via Figure 5. The size of each of the mentioned hindrances indicates how frequently it has been mentioned.

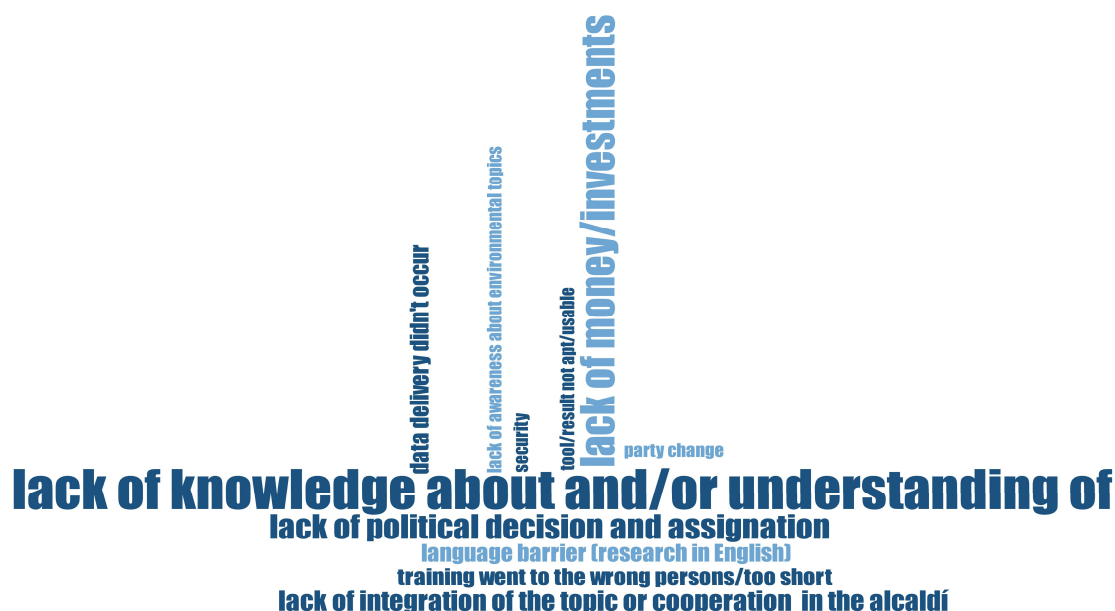


Figure 5 Code cloud on most frequently mentioned stumbling blocks for the usage of the WIS

It is notable that the category 'lack of knowledge about and/or understanding of the tool' is the biggest and thus, most frequently mentioned one.

After that, 'lack of money/investments' (to follow up the theses), lack of political decision and assignation and lack of integration of the topic/cooperation in the alcaldía are the next frequent ones.

5.2.2 Group Community Diagnostics

The next group of theses is the 'Community Diagnostics', where detailed data regarding specific villages' drinking water and sanitation situation were collected.

The first one was done by Liemberger (2018) in El Milagro, followed up by three more in El Milagro, San Francisco Angulo and Cantarrana (Schütz, 2018, Lasser, 2018, Kern, 2017).

The most recent thesis in this category is by Wiesmair (in progress), who tried to upscale the approach created by Schütz (2018) for 6 villages in the Southern Bajo Lempa.

As has been mentioned in 5.2.1, this approach was initiated by Liemberger, because she had to abandon her initial topic. She chose to focus on El Milagro, because she was in good contact with the president of the village's water board and it was easy to reach by public transport.

5.2.2.1 Knowledge about and usage of the results

El Milagro and San Francisco Angulo were later nominated 'Model Communities' by the alcaldía, where supposedly there were plans by the alcaldía to make choice investments in the villages to make them 'best practice cases' for the municipality.

The former mayor claims that these plans existed but could not be finished due to the change in administration. He further claims that these measures were delivered in a catalog of measures to the new administration. This catalog of measures could not be found and was unknown also to the alcaldía's head of the communications office, who shares a party with the former mayor.

Additionally, the master's theses had little impact in the cooperating villages (El Milagro, San Francisco Angulo and Cantarrana), as the results were never delivered to the villages. In the meantime, the drinking water systems of the three villages have also changed considerably as they were split from two water supply systems into three, supplied by three new wells that were constructed in the last two years.

The village councils and water boards, as well as the NGO responsible for the drilling of the wells, and a company that had provided funds for a water pump for El Milagro, were asked whether they had used the created results.

The village councils and water boards all bemoaned the fact that they had not received the results and did not see much use for them in the water related studies any longer, considering the change in supply systems. However, they were highly interested in the sanitary diagnostics.

The contact person at the company that sponsored the pump said that the information regarding the drinking water systems had not been relevant to them as they only provided funds for the pump desired by the water board.

NGO 3 stated the following:

"The water board did mention some studies to us. But they were not relevant to our work because we only drill the wells and don't need detailed information on the supply system. [...] Any further investments and decisions are the responsibility of the water board."

This shows that no 'hard use' (decisions or investments based on the studies) has occurred for these theses. Instances of 'soft use' could be found when interviewing former cooperation partners in the villages, where they stated that they had learned new things in the course of the cooperation.

The cooperators of the most recent study by Wiesmair (in progress) were also interviewed. Knowledge about the study was of course very high as Wiesmair's field research had only occurred three months prior to the interviews.

Five out of six village councils found that the study had been at least interesting for them and some claimed to have gained new knowledge. This can be considered an indicator for 'soft use'. Another instance of 'soft use' could be found with the health promoters of the researched area, who had been close cooperators to the study. One of them stated that he now used the questionnaire created in the study as a template for questions on sanitation he had to ask during his house visits.

In this case, also two instances of 'hard use' could be found:

The village council of one village stated that they had taken measures towards community clean-ups, as well as the organization of workshops by the health ministry about the adequate use of Urine diverting dry toilets (UDDTs). The president of the council stated that this had been motivated by the work they had done in cooperation with the researcher.

Thus, this is a prime example of a 'real life impact' as defined in 0. Not only has a positive change in village policy been made, but also this change was initiated by the study.

It must of course be taken into consideration that Wiesmair's study was conducted much more recently. It is possible that such instances of 'hard use' or even impact may have occurred also with previous studies but had been forgotten about in the meantime.

This exemplifies why that, for this thesis, it was decided to use 'hard' or 'soft' use as indicators for impact instead of looking for impacts themselves. The difference in time passed between studies would make comparisons of impacts between them too unreliable. For a more detailed discussion of this, see 2.

The following Table 7 will resume the interviewees' level of knowledge about the study results and instances of 'hard' and 'soft' use:

Table 7 Knowledge about and usage of the results of the Community Diagnostics (resume)

Knowledge about it	Instances of ,actual hard use'	Possible future ,hard use'	Instances of ,soft use'
25 out of 31 interviews knew about it (including 5 students). Only 2 of the collaborators ¹⁴ received results	Diagnostic in Bajo Lempa: 2 instances of 'hard use' found in village politics	6 interviewed village councils see possible future use in study that is yet ongoing	13 instances of 'soft use' ('I learned something') could be found, in both the finished and ongoing studies
11 collaborated with study still in progress ¹⁵	Diagnostics in Central Tecoluca: no instances of ,hard use' occurred, data was not delivered and system has changed in the meantime	Former mayors says that 'usage would have occurred if not for administration change'. Measurement catalogue containing measures in 'Model Communities' could not be found	
10 collaborated but didn't receive results			

5.2.2.2 Stumbling blocks

A resume of most frequently mentioned stumbling blocks in the usage of results of Community Diagnostics will be presented in Figure 6. As the graph shows, the hindrance that was mentioned most frequently was the lack of follow-up investments or budget.

The stumbling blocks that were the second most frequently mentioned were 'language barrier' (i.e. that the final theses and results were only available in English) and 'data delivery didn't occur', that is to say that the final results had not been delivered to the cooperating villages.

14 Not including students

15 That is to say, the results are not yet available.



Figure 6 Code cloud on most frequently mentioned stumbling blocks for use of the Community Diagnostics.

5.2.3 SPT

The final group to be considered is the ‘SPT group’ that as of today only consists of one master’s thesis (Döber, 2018).

This group is the one that includes by far the lowest number of interviewees who collaborated in the research. Considering that this group contains only one thesis and that the tool was designed for all of El Salvador instead of Tecoluca specifically, this is hardly surprising.

It is also necessary to consider that the person who was mentioned as the main collaborator at the alcaldía by the author no longer works there and could not be reached for an interview.

5.2.3.1 Knowledge about and usage of the tool

The student, who worked on the SPT, stated that even though he was in contact with several firms and government agencies, the response rate was generally low and that his main sources of information were a national plan on sanitation published by the environmental ministry (MARN) in 2017 and at the alcaldía the head of the communications office and one architect at the planning unit.

He also explained that this architect asked to receive a copy of this tool but he didn’t send it because he only managed to finish it back in Austria a year later.¹⁶ Also, he didn’t see much use in sending the final thesis if it existed only in English. So, in the end, he didn’t send the final thesis or his results to anybody in Tecoluca.

¹⁶ In the meantime, the administration change had already occurred. The exact date when this person left the alcaldía’s employment is not known but it is likely that she didn’t work there anymore at the date when the thesis was finished.

Results

Thus, it is not surprising, that out of 6 interviewees in this group, only 2 knew about the tool (one of them being the student) and no instances of 'hard use' could be found.

Furthermore, when asking the head of the alcaldía's cooperations office, for which of the theses he saw possible future applications, he didn't mention this thesis among them. However, this is not surprising considering the overall low level of knowledge about the thesis and the tool.

It is possible that the collaboration was 'softly useful' for the cooperating architect, but this can only be suspected as this person was not interviewed. However, a current architect at the planning unit, who was also a colleague of the cooperator in question, has no knowledge about the thesis or the tool.

A resume of the level of knowledge and usage of the tool follows in Table 8:

Table 8 Knowledge about and usage of the SPT (resume)

Knowledge about it	Instances of ,actual hard use'	Possible future ,hard use'	Instances of ,soft use'
2 out of 6 interviewees know about the tool (1 of them being the student)No instances of hard use could be found	No instances of hard use could be found	Head of the alcaldía's cooperations unit didn't mention this tool and thesis among those for which he saw possible future use	1 instance of 'soft use' possible but not proven (collaborator was not interviewed)
1 main collaborator could not be interviewed so her knowledge about it can only be inferred			
4 out of 6 don't know about it			

5.2.3.2 Stumbling blocks

The most frequently mentioned stumbling blocks can again be found in Figure 7. The graph shows that the three stumbling blocks that were mentioned more than once are the 'lack of knowledge about and/or understanding of' the tool, the 'language barrier' (i.e. final theses are delivered in English) and 'data delivery didn't occur'.



Figure 7 Code cloud on most frequently mentioned stumbling blocks for use of the SPT

5.3 Visions and Recommendations for the future

After looking at the past with the challenges during the studies (research question Q1) and the present day with the knowledge and usage of the results (Q2), we now focus on the interviewees' visions for the future (Q3).

5.3.1 Recommendations by students

The recommendations for the future given by students were classified in overall categories. They are presented by number of students mentioning them and frequency of mentions in Table 9:

Table 9 Recommendations for the future given by students, by students mentioning them and by mentioned frequency

Aspect	No. of students	% of Students	No. of mentions	% of mentions
Investments/financial Measures	9	100	19	11
Awareness raising/training etc.	9	100	34	20
Recs. towards the organisation by BOKU and/or students	9	100	39	23
Further cooperation build-up	7	78	23	13
Recs. regarding future research	7	78	23	13
Recs. towards issues with cooperation partners	6	67	16	9
Recs. towards ethical challenges arising in the interface of thesis work 5 and project work		56	7	4
Recs. for the knowledge transfer between students	3	33	3	2
Focus on other topics first/abandon approach	3	33	8	5
Total of students giving recommendations	9	100	-	-
No. of recommendations	-	-	156	

5.3.1.1 Follow-up investments

Table 9 shows that all students gave the recommendation, that some form of **follow-up investment** should take place after the research is completed.

The most frequently asked for investment is an expansion of the alcaldía work force with more specialized employees in the areas of WASH and GIS.

The second most frequent demand is that follow-up projects are planned for the obtained research results.

The third most mentioned demand is that an investment towards professional translations of the finished theses is made.

5.3.1.2 Measures towards awareness-raising

All students also give recommendations on **awareness-raising**. Recommendations in this category go towards:

- routine trainings and workshops of and with alcaldía staff and members of village committees and boards
- strategies for routine delivery of finished studies to villages and cooperation partners. Some students recommend doing final presentations in all cooperating villages and to all cooperation partners; others propose that the following students present the previous results; others favour the idea of a 'symposium', as has been proposed by INTERSOL.
- The necessity of preparing and presenting the data in a form that is apt for non-scientific uses is also mentioned by three students.
- Other forms of awareness-raising that are proposed are the writing of newspaper articles, posting the finished studies on the alcaldía's homepage and doing radio interviews at the local radio station.

5.3.1.3 Organizational measures by BOKU and/or students

Recommendations towards **organizational measures that fall under the responsibility of BOKU members** (either the supervisors or the students themselves) were also given by all students.

These measures are further defined in Figure 8.

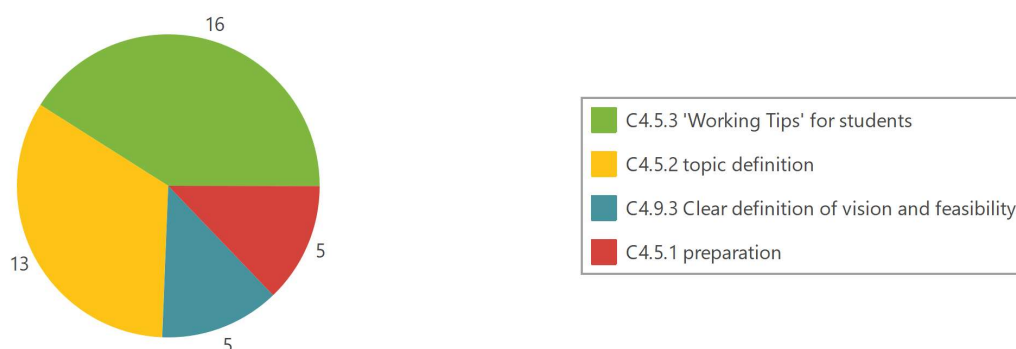


Figure 8 Recommendations by students on organizational measures by BOKU and/or students, by frequency of mention

The biggest part of the recommendations in this category (41%) falls under 'working tips' for students and contains a list of tips and tricks that students can apply during their field research in Tecoluca. They can be found in the Apendix (Attach. 5).

The next biggest part of recommendations goes towards the topic definition. However, in this field, students don't quite agree on the optimal way to do things:

Four students recommend that the students' topic should be broad and open to adaptations when coming to Tecoluca. However, two students, who had to change their topic when they came there, recommended to choosing a fixed topic before leaving Austria.

Student 7 applied the following strategy, that could serve as a middle course in this issue: She came to Tecoluca with a fixed, relatively small topic which she then broadened how she saw fit.

One student also recommends to the supervisors, that they should advertise a broader list of possible future topics.

13% of recommendations in this category go towards the definition and communication of the overall aim of the research cooperation. Two students propose that BOKU and INTERSOL should demand that the alcaldía clearly define their aims and goals regarding this cooperation.

Another 13% of recommendations go towards the students' preparation while still in Austria. Four students recommend a deep going preparation of students before they leave for Tecoluca. Student 2 asks specifically for more detailed preparation regarding ethical aspects of the conducted research, Student 9 demands a focus on the feasibility of the planned project.

5.3.1.4 Extension of the existing cooperation network

Seven students also stated that a further **extension of the network of cooperation partners** would also be helpful. The recommendations in this category are depicted in Figure 9: Six students propose

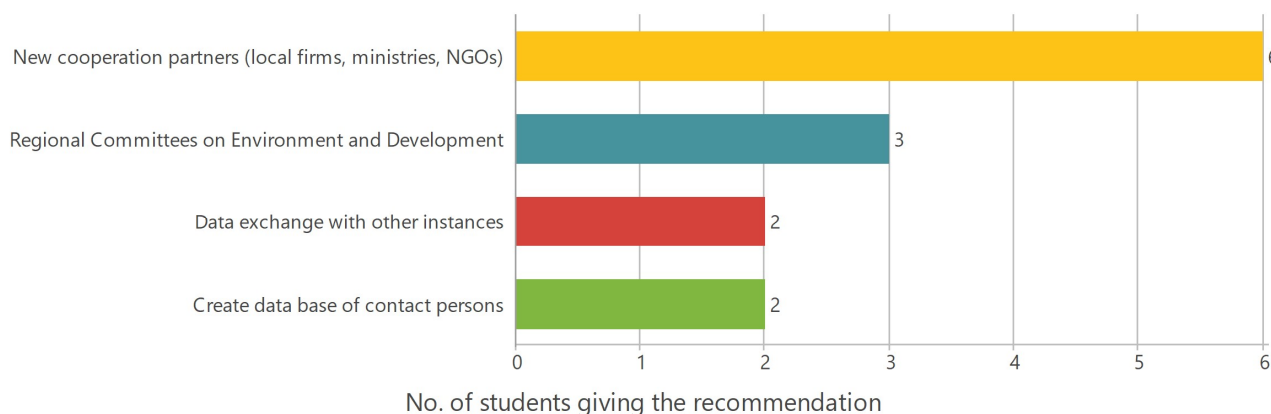


Figure 9 Recommendations on the extension of the existing cooperation given by students, by no. of students

the inclusion of new cooperation partners (such as local companies, local and national ministries, and local NGOs). Three recommend the creation of regional committees on environmental and developmental issues that include all sectors. Two each recommend exchanging data with other institutions and the creation of a contact persons data base to facilitate future research.

5.3.1.5 Recommendations for future research

This category of course also falls under 'Organizational measures falling under the responsibility of BOKU members' (see 5.3.1.3), but as 7 students gave recommendations specifically towards this topic, this category stands on its own.

10 of the 22 recommendations in this category are proposals for future research topics. Topics that are mentioned here go towards the use of faeces and urine from latrines, other measures of improvements of the applied sanitary systems, the upscaling of village-level studies and the use of apps by water board members to transmit data to the alcaldía.

9 recommendations go towards applying more participatory approaches in the future, not only in the methods used for research but also in the topic definition.

2 recommendations go towards providing support to the alcaldía in the definition of their vision for the research program and 1 person recommends asking for a political commitment to the research and its results.

5.3.1.6 Recommendations towards issues with cooperation partners

Also in this category, the biggest part of recommendations (10 out of 16) can be categorized as 'Working Tips' for students. They are tips that can be applied in everyday situations to facilitate the cooperation with other people during the students' research. A list of them can be found in the Annex (Attach. 5).

In four cases, communication is proposed as the best solution when dealing with cooperation partners. Two students also demand that the alcaldía take a leading role as a communicator with other cooperation partners.

5.3.1.7 Proposed solutions for ethical challenges in the thesis work

When looking at Table 9, one can see that five students gave seven recommendations in this category. This number is relatively low, considering that 'ethical challenges arising on the interface of thesis and project work' are among the most frequent challenges experienced by students (see Chapter 0).

This seems to show just how hard this struggle was for students, because they could not find many solutions to the problem.

The solutions they have proposed are:

- routinely combining the thesis work with project work, that is to say to connect research and some form of follow-up investments (be they monetary, or in form of trainings etc.) as often as possible.
- Communicating constantly with cooperation partners, that the aim of the research is the research itself and nothing more. Student 6 also demanded in this case, that the alcaldía take a leading role in communicating this issue.

5.3.1.8 Recommendations towards the knowledge transfer between students

Several students also bemoaned the lack of baseline data (see 5.1.2) and the loss of knowledge between students.

3 students gave recommendations for facilitating the knowledge transfer between students, these being:

- sending the next students when the previous ones are still in Tecoluca. However, contrary recommendations on this topic have also been given because other students found that finishing theses before starting the next ones is a better approach.
- creating a routinely updated data base for results and contact persons

5.3.1.9 Focusing on other topics first/abandoning the current approach

This recommendation was given by three students. They reflect that other issues, such as security or quantity of drinking water¹⁷, may be more critical for the people of Tecoluca.

Student 9 also proposes to abandon the research approach by master's theses but rather proposes the following:

"I have generally become critical of the practice of doing one's master's thesis in a development cooperation context. [...] I think doing practices, such as the 'Konstruktives Projekt' or doing whole dissertations in Tecoluca would be better."

5.3.1.10 Who should do what?

Finally, we will look at who the students have actively named as groups of people responsible for making changes in Figure 10:

17 In contrast to drinking water quality or environmental sanitation

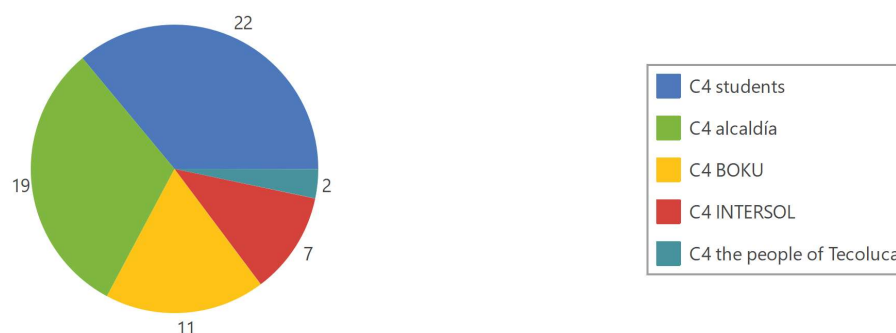


Figure 10 Responsible institutions for making changes as mentioned by students, by frequency of mention

The graph shows that out of 61 times that specific institutions have been mentioned as being responsible for making changes, 36% of recommendations go towards students. 31% of changes should be made by the alcaldía, 18% by BOKU and 12% by INTERSOL.

5.3.2 Recommendations by alcaldía members

18 interviews were held with actual and former alcaldía staff members and decision makers.

The most frequently mentioned recommendations go towards awareness raising. Six interviewees proposed workshops, three demanded that created results and theses be actually delivered, three proposed to put the finished studies and tools on the alcaldía homepage, and one person each recommended training and monitoring with and for alcaldía members, using simple language for data delivery and putting results and tools on the alcaldía wall paper.

Sixteen recommendations go towards future research. Twelve of the interviewees propose to ask for political commitment to the research and tools, two propose future research topics (towards state and discharge of rivers, and risk zones), and two just recommend to 'keep up the good work'.

Nine interviewees recommend solving remaining technical issues of the tools (specifically the WIS). Three recommend to actualize and broaden the WIS and again three mention that the question of who shall which access rights must be solved.

Eight interviewees propose measures that fall under the category of 'investments/financial aspects'. Five of them propose looking for subsidies, two recommend employing additional staff at the alcaldía and one plans to sensitize his constituents towards paying their taxes.

The interviewees gave six recommendations towards organizational aspects that fall under the alcaldía's responsibility, these being strengthening inter-unit cooperation (5 mentions) and the alcaldía taking a leading role in the usage, maintenance and broadening of the WIS.

Six recommendations are given towards the extension of existing cooperation networks. These are: taking part in regional committees on environmental topics, sharing data with other organization and the students having tutors at local universities.

Regarding 'problems with cooperation partners', four alcaldía members have one recommendation: They felt that they were the wrong cooperation partners for their specific task and that the students should cooperate with other people who have the 'right' working field.

3 people recommend that the theses should be directly combined with projects.

Two recommendations are given regarding organizational aspects that fall under BOKU responsibility: The students having tutors at local universities, and giving an initial presentation about the planned research at the alcaldía that is open to the public and all alcaldía members. This shall

serve as a measure of awareness-raising and helping the students find relevant cooperation partners.

Fehler! Verweisquelle konnte nicht gefunden werden. shows a code cloud of recommendations given by alcaldía members:



Figure 11 Code cloud for recommendations by alcaldía members

This graph shows that the measure of ‘demanding political commitment’ is the most frequently mentioned, followed by looking for subsidies, assigning a unit to the GIS, and giving workshops to the ‘right’ recipients, and working on inter-unit cooperation.

5.3.3 Recommendations by village representatives

13 interviews were held with representatives of Tecolucan villages. Most of these interviews were group interviews either with village councils or water boards. For reasons of simplicity, the term ‘interviewee’ will be used to refer to individual interviewees as well as group interviews.

Their proposals most frequently fall under the category ‘future research’. Eleven of the interviewees ask for more participation in the research or are already happy with the elevated level of participation that was applied in the most recent study by Wiesmair (in progress). However, one of them asked for less participation because he felt that he as a village member wasn’t impartial enough to conduct interviews.

3 gave recommendations for future research topics (environmental impacts of sanitation practices, their drinking water situation¹⁸, and a hydraulic simulation of their water supply system).

Regarding ‘organizational aspects falling under BOKU responsibility’, one demand was made by 8 interviewees: that data of research realized in their villages be delivered.

18 This was proposed for the villages where studies had only been conducted towards their sanitation situation.

Four proposals are made that fall under 'investments/financial aspects': 2 interviewees propose follow-up investments after the studies, one demands that an investment in translations is made, and one interview group recommends that studies should also include cost analyses.

Three recommendations are made for awareness raising and publication, such as conducting workshops in each of the cooperating villages.

Two recommend that thesis work be automatically combined with project work.

Figure 12 again depicts all recommendations by mentioned frequency.



Figure 12 Code cloud for recommendations by village representatives

It becomes clear that the biggest demand is that data and results created in and with their village actually be delivered.

The two measures that are mentioned second most frequently go hand in hand:

One is a direct desire for more participation, the other ('[more participation] in the methods') is a direct recommendation on how participation should be even higher in the future: Four interviewees recommend that in the future, lists of the village members are taken from the village councils (ADESCOs), because they are more recent.

5.3.4 Recommendations by representatives of cooperating universities

The two contact persons at the cooperating local universities have been interviewed. They give the following two recommendations:

- extension of the existing cooperation. Both propose formalized cooperations between their universities and BOKU. UES also proposes that existing theses could be translated by students of their English department.
- Abandoning the project in Tecoluca: While UCA does see a possibility for formalized future cooperation, they don't want this cooperation to take place in Tecoluca.

5.3.5 Recommendations by other institutions

In this chapter, recommendations given by interviewed state institutions (such as MINSAL and ANDA) and other NGOs working in WASH in Tecoluca are resumed. This group includes 14 interviewees.

The most frequent recommendations fall under the category of 'awareness raising'. Some of these recommendations are: publishing the finished studies on the alcaldía homepage, organizing a symposium, and working on empowerment processes with the villages (so that they dare demand their rights with various institutions).

7 of the interviewees also propose an extension of existing cooperation. Here, three of the interviewed NGO representatives propose that they be included in the cooperation. Two recommendations go towards taking part in and forming regional committees on environmental and developmental topics. One interviewee recommends data exchange with other institutions and maintaining personal contacts with other NGOs that work in similar topics in the same area.

Four give one single recommendation, that goes towards organizational aspects that fall under BOKU responsibility: All four stress the importance of actually delivering created results, tools, and theses. In the instances where they have cooperated to some extent in past theses, they would also wish to receive the final product.

Three recommend measures that fall under 'investments/financial aspects': Focusing on latrine maintenance in construction projects, assigning at least dissemination budget to the studies, and investing in translations.

Another two have proposals for future research (treatment of grey waters and health effects of chlorine in the drinking water).

One person recommends combining thesis work with project work. Another one proposes that the alcaldía institutionally and legislatively integrate environmental topics.

6 Discussion

6.1 Reflections on selected results

Looking back, one can see that the biggest challenges for students were of ethical and organizational nature.

Knowledge about and usage of the created results and tools is generally low, though especially knowledge is higher for the 'Community Diagnostics'. For both the WIS and the SPT, the biggest hindrances of their usage was the lack of knowledge about the tools. For the Community Diagnostics, the biggest hindrances were the lack of money or investments and the fact that data and results were not delivered (in Spanish).

The most frequent recommendations over all groups went towards awareness-raising. This is unsurprising considering that lack of knowledge is the main stumbling block in the usage.

6.1.1 Amount of knowledge/usage vs. effectiveness of usage

The fact that knowledge about the research was higher in the category of 'Community Diagnostics' and more occasions of use could be found seems to indicate that 'simpler' topics that are easier to grasp for lay persons are the best way to go forward in the future. However, when introducing new IT technologies in development cooperation contexts, the assumption is that a 'trickle-down effect' to the general population will occur via the freeing of capacities by higher effectiveness in administration and the promotion of innovation (Kaushik & Singh, 2004).

A possible conclusion of this is that with IT based tools, not the amount of people who know about them is critical, but that those who do, use them to the greatest effect for those around them. Thus, a central point is that the 'right' people know about the tools and use them. As has been mentioned in 5.2.1, those who had been given administration and editing rights to the WIS felt that they were not the 'right' persons for these tasks:

„For the future I recommend that the role of administrator be given to the head of IT and that they be properly trained in this role. [...]The [editing users] should be those who can most likely use the tool in their day to day work, such as the environmental unit, or planning, or cadastre.“ (Alcaldía 8, former alcaldía member who had been designated as administrator of the WIS)

One take-away for future research is that finding the cooperation partners who are most likely to want and be able to use co-created results and tools is a crucial step in guaranteeing their actual usage afterwards.

6.1.2 Possible future steps for the WIS

Another recommendation regarding the WIS, that was mainly given by administrative alcaldía staff members, is pushing for political commitment to the tool and assigning its actualization, maintenance and usage as official work tasks to selected alcaldía units:

„The first thing that needs to be done is to present this [tool] to the municipal council and ask for a political decision for its usage. [The tool] must be assigned to a specific [alcaldía] unit so it can become part of our daily work routine.“ (Alcaldía 1, at a meeting on the 'reactivation' of the WIS)

The call for political commitment toward the (existing and future) research has been voiced frequently, by both alcaldía members and students, and regarding all research groups, not only the WIS. This will be discussed later in more detail, but for now we will focus on 'routine actualization' of the data in the WIS:

This step has been a point of contention in the past. Who is supposed to take actualized measurements? The students? The alcaldía? The communities' water boards?

Regarding the water discharge and quality, some research has been done towards automatized measuring (Deras Aquino et.al., 2016; Grande Cobar & Mirón Acevedo, 2017; Lasser, 2018), but no steps towards finalization and installation of these tools in Tecolucan spring captures have been taken. This issue continues and needs further consideration in the future.

However, when it comes to household level data on the communities' WASH situation, a yearly actualized data set exists and could be easily integrated into the WIS:

MINSAL collects yearly household data on the demographic, education and labour, drinking water, sanitation and other characteristics of all El Salvadorian households via their health promoters (MINSAL, 2015). While this information is mainly collected digitally and pooled at health unit level, paper resumes at community level are to be delivered to the health promoters' coordinators.

The integration and yearly actualization of this data into the WIS would make sense on two levels: For one, it would feed the WIS with basic, actualized data. As has been mentioned in 5.2.1, even having a tool with demographic data on Tecoluca's communities would facilitate alcaldía staff members' work.

For another, the integration of this data into the WIS' underlying data base would be quite simple, as the data base is already designed in a way that is apt to receiving this data: Schaidreiter (2016) and Biber (2016) had already had access to this data set for 2015 and Rossmann (2017) incorporated it in the basic design of the data base. However, as it has become clear in their interviews, the students did not know that this data set was actualized yearly and could be updated in the WIS every year.

6.1.3 Preparation of students before going to Tecoluca

When looking at recommendations regarding organizational aspects, that fall under BOKU responsibility, the most frequent demand goes towards a more profound preparation of the students before they leave for Tecoluca (not taking into account the 'Working Tips' for students).

It was recommended specifically that ethical aspects and the feasibility of the planned study are considered beforehand, but also 'more preparation' in general has been demanded by many.

The question of how this preparation should be conducted is contested between students. Some demand that a small, specific topic should be defined while still in Austria and preparation should focus on this topic. Others recommend that the research question should remain somewhat open so as to allow for adaptations to local conditions.

Both sides present valid arguments: The first remind of the limited time for data collection abroad and the latter argue that giving the alcaldía or other key stakeholders a bigger role in topic definition may increase relevancy of the results for them.

If the modus operandi is to remain the same (that is to say, by realizing master's theses in Tecoluca, which will always have a quite limited time frame), this would mean that it should be intended to include the alcaldía and other prospective cooperators in the preparation of the thesis as much as possible, even before leaving Austria.

This is of course easier said than done, due to reachability of stakeholders across continents and language barriers. The simplest solution in this issue would be to heed Student 7, who had recommended to choose a very small, defined topic and to broaden it abroad, when possible.

This approach would also make the realization of small 'feasibility studies' of planned topics and methods possible, as has been demanded by Student 9.

As has been mentioned, the topic definition is not the only area on which students desire more preparation. Student 2 specifically recommended a stronger focus on ethical aspects of the field research. She recommends that possible ethical challenges of the planned research are considered beforehand and students be prepared on strategies of how to deal with them.

While only one student gave this specific recommendation, putting a focus on ethics in the preparation of students may be helpful to all. The reason is that all students experienced ethical challenges in their field work, but they could not find many strategies on how to deal with them. More on this follows in the next subchapter.

6.1.4 Dealing with ethical challenges in field research

As has been mentioned, all students were faced with ethical challenges in their field work, but they didn't have many ideas as how to deal with them.

Among the recommendations that were given, the most frequent one is combining the research work more directly with project work. That is to say that follow-up investments and/or workshops and trainings should be planned beforehand and should be a routine part of the thesis. Contrarily, the referred to 'project(s)' could be the starting point and the theses could be designed to complement them.

This would of course require funds, which are always limited. Working closely together with other NGOs in the area who are already realizing projects in WASH in Tecoluca may be a way to channel resources, be they financial or human.

Other recommendations, that students gave to deal with ethical challenges go towards communication; and also abandoning the current approach in favor of doing a more direct project approach via practica or dissertations.

Again, preparation for ethical challenges are also critical.

6.1.5 Financial Aspects

Both village members and students saw the lack of funds as one of the main stumbling blocks. While this aspect was not mentioned quite as frequently among all alcaldía members, one leading alcaldía member especially stressed its importance.

However, - as has been mentioned -, funds are always limited. NGO 2 gave the following recommendation as a possible middle ground:

"The technical cooperation is very valuable. But if there is no budget line, the studies can't be realized. There are very good studies, but if there are no resources they can't be realized. [...] I would recommend that some budget is assigned to the studies, at least for their dissemination."

Again, furthering the cooperation with other NGOs in the area of Tecoluca may be a way to lighten the financial burden.

6.1.6 Dissemination strategies

The (possibly perceived) lack of data delivery and dissemination is seen as a major stumbling block for the usage of results and tools among students, village members and alcaldía members.

Students, village members, alcaldía staff and other interviewees all give recommendations on how to disseminate results. As can be seen in the previous subchapter 6.6, even other NGOs give recommendations in this regard.

University 2¹⁹ proposed a more in-depth cooperation that could also include an agreement where the translation process of finished theses is assisted by their English students. Attempts toward the organization of this have been made, but due to the limited time frame, more work towards this would be necessary.

Also in the topic of translations, Student 6 also proposed that INTERSOL provide funds for the professional translation of the theses. This would go hand in hand with the recommendation by NGO 6, that was presented above, about the assignation of dissemination budget.

Other recommendations for the dissemination of finished and future studies are presentations, workshops, and also more unusual channels such as the radio, the alcaldía's wallpaper and publications, and the alcaldía's social media.

One specific recommendation by Alcaldía 12 shall be highlighted again: They recommended an initial presentation by in-coming master's students open to all alcaldía members (not just the municipal council) and the general public, where they present the aim of their research and connections for cooperation can be made with a wide range of alcaldía employees. This of course would not be classified as 'dissemination of results', but rather as spreading the knowledge about the theses while they are still in the works. It would also facilitate students' access to a wider range of alcaldía experts, not only in the cooperation office.

Many of the more specific recommendations have been given by alcaldía staff. The issue of optimal dissemination of results is one in which the alcaldía has a lot of expertise and could be asked to take on a more leading role in the future.

Creating (additional) strategies how to routinely deliver results are an important step in making BOKU thesis results usable and used in Tecoluca.

6.1.7 Demanding political commitment

It has been mentioned in the previous subchapter, that the alcaldía could be asked to take a more leading role in the organization and realization of dissemination activities.

This is not the only area, in which more direct involvement of the alcaldía is demanded:

Both students and alcaldía staff (it is important to note here, that this demand is made by alcaldía staff, not alcaldía decision makers) recommend that the municipal council be asked to make a political commitment to the application of (finished and future) BOKU results and tools, such as assigning the maintenance and usage of the WIS as official work tasks to specific units.

Students 2, 6 and 8 also demand that the alcaldía communicate their goals and plans for the cooperation clearly. Student 8 in specific proposes that cooperation activities focus on providing an arena, where decision makers can sit down together and define goals – and how to reach them – for the Tecolucan WASH sector together.

This leads to the final recommendation:

6.1.8 Symposia or Round Tables

The organization of regional round tables or symposia on WASH and development has been proposed by several interviewees, some of them students (see above), one of them another NGO working in WASH in Tecoluca.

19 The university that is being referred to is UES. Naming this interview partner of course ruins any attempt at anonymity, but they will be named here in order to make working with them in this issue again in the future easier.

Organizing such a one-off event (or even a recurring committee), where representatives from the alcaldía, relevant local ministry branches, village water boards and ADESCOs, and locally active NGOs and universities can sit down together and discuss, could fulfil several purposes:

BOKU's and other universities' WASH related results and tools could be disseminated, goals for Tecoluca's future in WASH could be defined and definitive plans made, and the cooperation and thus channelling of resources between NGOs, government branches and villages could be strengthened.

Such a symposium has been envisioned by INTERSOL already, but definitive steps towards the organization still need to be done.

6.2 Limitations of the Approach

Regarding the Results found in Chapter 5 and the conclusions drawn in this discussion, several limitations to the applied research approach have to be considered:

For one, applying a fully qualitative approach using interviews leads to the gathering of people's opinions and perceptions instead of 'hard facts' on the realized studies' impacts.

One of the concerns regarding open interviews is, that the interviewees may tend to give answers that they think are 'what the interviewer wants to hear' (Henslin et.al., 2013, p. 111). This risk is especially great in the present research, as the interviewer forms part of the same organization as the organizers of the research program.

However, it is decided that the applied approach collecting perceptions is sufficient to fulfil this thesis' objective which is to depict general tendencies as a basis for decisions on the future of the research program.

For another, the time lapse in between the respective field works in Tecoluca and this master's thesis has to be considered: While the student as well as the cooperators of the most recent thesis could still well recall the study and its perceived impacts, stakeholders had difficulties in recalling theses that had been realized a longer time ago. This phenomenon of distorted recall after a time lapse is called 'recall bias' and is considered to be higher for surveys where contestants are free to volunteer answers instead of being prompted (Teschke et.al., 2000). From this, one has to conclude that possible future evaluations within this research program should take place shortly after their realization and ideally with standardized survey approaches.

The time lapse also meant that in many instances, new people filled roles of former cooperators. It was not possible in all cases to find and interview the former cooperators.

The approach of the 'problem analysis' also affected the presented results. As the name applies, a focus is taken on problems and challenges instead of positive effects. One example for this was presented in Chapter 5.1.5 (Organizational challenges that fall under alcaldía responsibility):

Considering that the Table 5 depicted 'challenges', it showed that two students had experienced a lack of interest in their work by the alcaldía. However, it did not depict the seven students who had felt a strong interest in and support for their work from the alcaldía.

While this issue is not widely discussed in evaluations circles, there are several studies in the area of coaching that show that while problem-focused coaching and solutions-focused coaching will both better results and bring similar solutions, the effects of solutions-focused coaching will be higher and will lead to a deeper understanding of the nature of the problem (Braunstein & Grant, 2016, Grant & O'Connor, 2010).

One final aspect has to be considered as well when looking at the presented results: this research program is embedded in the context of El Salvadorian WASH governance. The high polarization of El Salvadorian politics (Garibay, 2005) and the country's lack of comprehensive WASH legislation (see Chapter 3.1.1) are only two factors that hinder effective WASH governance and research.

7 Conclusions and Outlook

The objective of this thesis was to depict the state of BOKU WASH research in Tecoluca, by finding challenges students faced while realizing their field work, approximating the impact of the finished results via the level of knowledge about them and their usage, and by recollecting key stakeholders' recommendations for the future.

A wide range of challenges and recommendations was given by a wide range of interviewees. In the following, they will be condensed and concluded very shortly regarding the three research questions (see chapter 4.3):

The most frequent challenges experienced by students were in the fields of cooperation with other partners, organizational aspects and ethical aspects. While students could find proposals and recommendations for easing the first two, they could find very few solutions on how to deal with ethical problems.

This shows how critical this challenge is, and that students are in need of additional support in this issue. The planning and preparation of future theses should take a focus on this.

Regarding research question Q2 (knowledge and usage of results and tools; and what hinders that), one has to say that the level of knowledge about the results and tools is very low. Among the group of 'Community Diagnosticians', the knowledge about the realized research is highest and also some instances of political decisions by ADESCO leaders based on them have been found.

This shows that the level of knowledge about the results and tools is essential for their application. For future theses, strategies for dissemination should be planned even before leaving for Tecoluca and routinely conducted.

Regarding the more 'technical' theses and results on the WIS and the SPT, they can only be used when the 'right' people know about them and how to use them, that is to say those who have the expertise, a use for them, and the ability to aid policy decisions with them.

Now on to the final topic of this theses: Which recommendations were given by the interviewees?

Overall, 313 recommendations on the future of the research program were given. The vast majority of them were based on the continuation of the research program. Only three interviewees contemplated the abandonment of the research program or a fundamental switch of the working mode.

This shows that while people do see potential for improvement, the general support of the research program is high.

To condense these 313 recommendations, I will stress the importance of only a few. Regarding the planning and supervision of future theses, I recommend a more in-depth preparation with a focus on the feasibility of planned theses and ethical aspects of the research. Also, the dissemination of theses should be considered a key part of the thesis process.

Both in regard to the ethical aspects of the research, as well as its dissemination, recommendations by interviewees have been made towards making financial investments along with the theses.

This is of course not the principal aim of the research cooperation and may also not be possible. Thus, I recommend working closely together with other NGOs and if budget is assigned, the expenditures should focus on dissemination and awareness raising.

Specifically towards the usage of the WIS, routine use by alcaldía staff is highly possible due to the administrative staff's interest in the tool and the existence of yearly actualized demographic and WASH data by MINSAL (see 6) that can be incorporated into it with relatively little effort. Putting in additional effort in this aspect would make sense because it would make the use of the tool, in which so many efforts have already been invested, possible.

Regarding the overall organization of the research program and INTERSOL's work on WASH in Tecoluca, I will back the demands of many interviewees and recommend the need to ask for the alcaldía's political commitment to the program.

The alcaldía could be assisted in the process of long-term goal definition by the organization of the planned symposium or recurring regional round tables on WASH. Realizing this in some form could help in the dissemination of previous results, the planning of future research and other activities, as well as strengthening the cross-sector and inter- and inner-institutional cooperation on WASH in Tecoluca.

8 Summary

A research cooperation on WASH topics exists since 2015 between BOKU's Institute of Sanitary Engineering and Water Pollution Control, the alcaldía of Tecoluca and the Austrian NGO INTERSOL. When starting off this thesis, 9 master's theses were in the works or already completed.

This master's thesis presents a review of the impact on Tecoluca's WASH situation of the research program.

To accomplish this, 54 semi-structured interviews were held with key stakeholders in the cooperation. 9 of them were with (previous) master's students, 18 with current and former alcaldía employees and decision makers, 13 with cooperating villages' water boards and village councils or representatives of them, and the rest were held with other interview partners such as representatives of local government agencies and other NGOs.

The interviews were held in the time from March to June 2019 while in Tecoluca, with the student interviews being held via video communication.

The topics of the interviews were challenges students faced during their research, levels of knowledge about created results and tools and their usage among local stakeholders, and the interviewees' recommendations on how to broaden this usage and how to conduct future research in this program.

Students majorly experienced organizational challenges, challenges in cooperation with partners, and ethical challenges in their field work.

Especially when it comes to ethical challenges, students could not find many solutions on how to deal with them. A deeper going preparation, where these ethical challenges they are about to face, are communicated to students, could be a first step towards easing this burden.

Knowledge about the created results and tools is generally low among local stakeholders and former cooperators. In the case of the theses during which community diagnostics were conducted, the cooperating villagers and village boards have a higher level of knowledge about the studies, but they could not make actual use of them due to late and/or incomplete data delivery. With the most recent master's thesis, which is still in progress, some instances could be found where community decision makers claimed to have made policy decisions based on the research.

In the latter case, preliminary results had been presented to the villages as well as the alcaldía. With the previous theses in this area, results had mainly been delivered only to the alcaldía.

The other theses, that have been conducted, focused mainly on IT tools such as a Water Information System and the CLARA Simplified Planning Tool. In their cases, few people knew about the existence of these tools in Tecoluca and among those who had editing and other rights, none had used them after their initial training.

Lack of political commitment to the tools by the alcaldía and them not being the 'right' persons to have received these rights and trainings were the most frequently given reasons for this.

Both cases, the community diagnostics as well as the IT tools, show the importance of data delivery and dissemination. Cooperators only have the chance to use results and tools, if they know about them sufficiently.

In the case of the IT tools, it is also critical that even before starting the thesis work, thought is put into who will be the prospective users. This makes it possible to involve them early on and train them sufficiently.

For future theses, it is recommended to design dissemination strategies even before leaving Austria and to make them a routine part of the thesis work in Tecoluca.

When it comes to the recommendations given by interviewees, over all stakeholder groups, they most frequently fell under the category of 'awareness raising'. This further undermines the need for broader dissemination strategies.

Another recommendation, that was given frequently among all stakeholder groups, was to include some form of financial investment in this cooperation. This could go towards investing in translation and dissemination, towards employing more alcaldía personnel in the area of WASH and research on it, or towards supporting the construction of WASH infrastructure.

However, resources are of course always scarce, especially in a program that focuses 'only' on research. One way to lighten the financial load would be to seek closer cooperation with other NGOs and institutions in Tecoluca to share financial and human resources.

One recommendation, while not given as frequently as others, could be used to deal with several of the mentioned issues:

It has been recommended to organize some form of symposium or regional round table, where Tecolucan WASH stakeholders among all sector can sit down together and discuss Tecoluca's current and future WASH situation. In fact, INTERSOL and the BOKU supervisors have already put thought into the organization of such an event.

It is important that this plan is also carried out, because in the course of this symposium (or other, recurring forms of such an event), BOKU and other WASH study results could be disseminated, decision makers could define goals for the future and how to approach them, and inter-organizational and inter- and inner-organizational cooperation could be strengthened.

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10.3 Master Interview Guide

¡Gracias por recibirme!

Soy Lena Ortega, provengo de la universidad BOKU de Austria. La alcaldía de Tecoluca tiene una cooperación desde hace varios años con la BOKU en cual se realizan estudios relacionados al agua y al saneamiento.

Cómo se han encontrado varios retos y dificultades en el proyecto, mi trabajo de tesis es analizar los impactos y problemas de los trabajos que se han realizado.

Para eso estoy entrevistando actores claves del manejo y la investigación en relación con el agua y el saneamiento en Tecoluca. Como usted también es un actor clave en eso, me gustaría hacerle unas preguntas.

Tema °1: Red de Cooperantes en Agua y Saneamiento y su investigación

Preguntas claves:

- presentarse y su rol en la organización
- ¿Qué conexión tiene usted con el agua y saneamiento en Tecoluca y las investigaciones al respecto de ese tema?
- ¿Qué trabajo hace usted/su organización en respecto al agua/saneamiento?
- ¿Cuáles (otras) instituciones gubernamentales conoce que trabajan en ese tema en Tecoluca?
- ¿Con cuáles de esos ha colaborado usted?
 - ¿Por qué esos?
 - ¿Cómo le fue/va en la cooperación?
- ¿Cuáles (otras) organizaciones conoce que trabajan en ese tema en Tecoluca?
- ¿Cuáles otras instituciones conoce que trabajan en ese tema en Tecoluca?
- Preguntas específicas al trabajo de ellos

Pregunta alternativa:

- ¿Qué estudios ha realizado usted o su organización en Tecoluca?

Tema °2: Conocimiento/Uso de los resultados de las investigaciones de BOKU en Tecoluca

Preguntas claves:

- ¿Cuáles estudios sobre el tema del agua o saneamiento en Tecoluca conoce?
- ¿Cuáles estudios sobre el tema del a/s en Tecoluca realizados por la BOKU conoce?
- ¿Conoce usted Sistema de Información de Agua de Tecoluca? ¿El SPT? ¿Los balances (hídricos) de agua? ¿Los diagnósticos de la situación sanitaria?
 - Sí: ¿de donde?
 - ¿Cómo los ha usado? → No: ¿Por qué no?
 - ¿Qué útil fueron?
 - ¿En qué hubieran podido ser mejor (más aplicable, diferente formato, tema, metodología...)?
 - No: explicar que es

Pregunta alternativa:

- ¿Cuál uso ve usted en ese tipo de estudio? ¿Para qué podría servir esa información (a usted, a Tecoluca)?

Tema °3: Ideas y visiones para el futuro

Preguntas claves:

- ¿Cómo fuera más fácil para usted y su organización acceder a ese tipo de información?
 - ¿De qué les podría servir?
- ¿Cómo se podría promover el conocimiento sobre y el uso de esas herramientas con la gente?
- ¿En qué podría ser diferente la información/la investigación para que sea más mejor/más aplicable?
- ¿Qué pasos se podrían tomar para mejorar la situación de agua y saneamiento en Tecoluca?
- ¿Qué debería hacer la BOKU para aumentar el uso de los resultados de sus investigaciones?
- ¿Qué debería hacer la alcaldía para aumentar el uso de los resultados de BOKU? (¿Quiénes?)
- ¿Qué hace su organización para mejorar la situación de agua y saneamiento en Tecoluca?
- ¿Sobre cuáles temas en respecto al a/s en Tecoluca se ocupan más información científica?
 - ¿Cuál tipo de información le serviría más a usted/su organización?
 - ¿Cómo se puede colaborar con usted? ¿Qué servicios puede brindar/ha brindado?

Tema °4: La investigación científica en Tecoluca (si aplica)

Preguntas claves:

- Selección del tema de investigación:
 - ¿Quién tenía la idea? ¿Cómo se desarrolló?
 - ¿Usted realizó el trabajo que había planeado desde Austria o lo adaptó a las condiciones encontradas?
 - Sí: ¿Qué era el tema original y porque no se pudo realizar?
 - ¿Por qué lo adaptó? ¿Por qué no lo adaptó?
- ¿Cuáles retos ha encontrado usted en su investigación científica en Tecoluca/en la de su organización?
 - Si se necesita especificación:
 - ¿Cuáles retos ha encontrado en respecto a las diferencias entre culturas?
 - ¿Cuáles retos ha encontrado con el acceso a la información que necesitaba?
 - ¿Cuáles retos ha encontrado en la cooperación con otros actores?
- ¿Cómo trató usted con esos retos?
- ¿Qué haría usted diferente ahora si volviera a hacer el mismo estudio?
- ¿En su opinión, cuáles pasos hacen falta ahora de parte de la BOKU o la alcaldía?
- Cooperación:
 - ¿Quiénes fueron sus cooperantes? ¿En qué y cómo cooperaron?
 - ¿Cómo involucraron a la gente?
 - ¿Cómo les fue en la cooperación?
- ¿Presentaron sus resultados?
 - ¿A quiénes? / ¿Por qué no?
- ¿Los tradujeron? Sí no: ¿Por qué no?
- ¿De qué les sirvió el trabajo de ellos a sus cooperantes?
- ¿Cómo se podrían divulgar los resultados existentes con la gente?

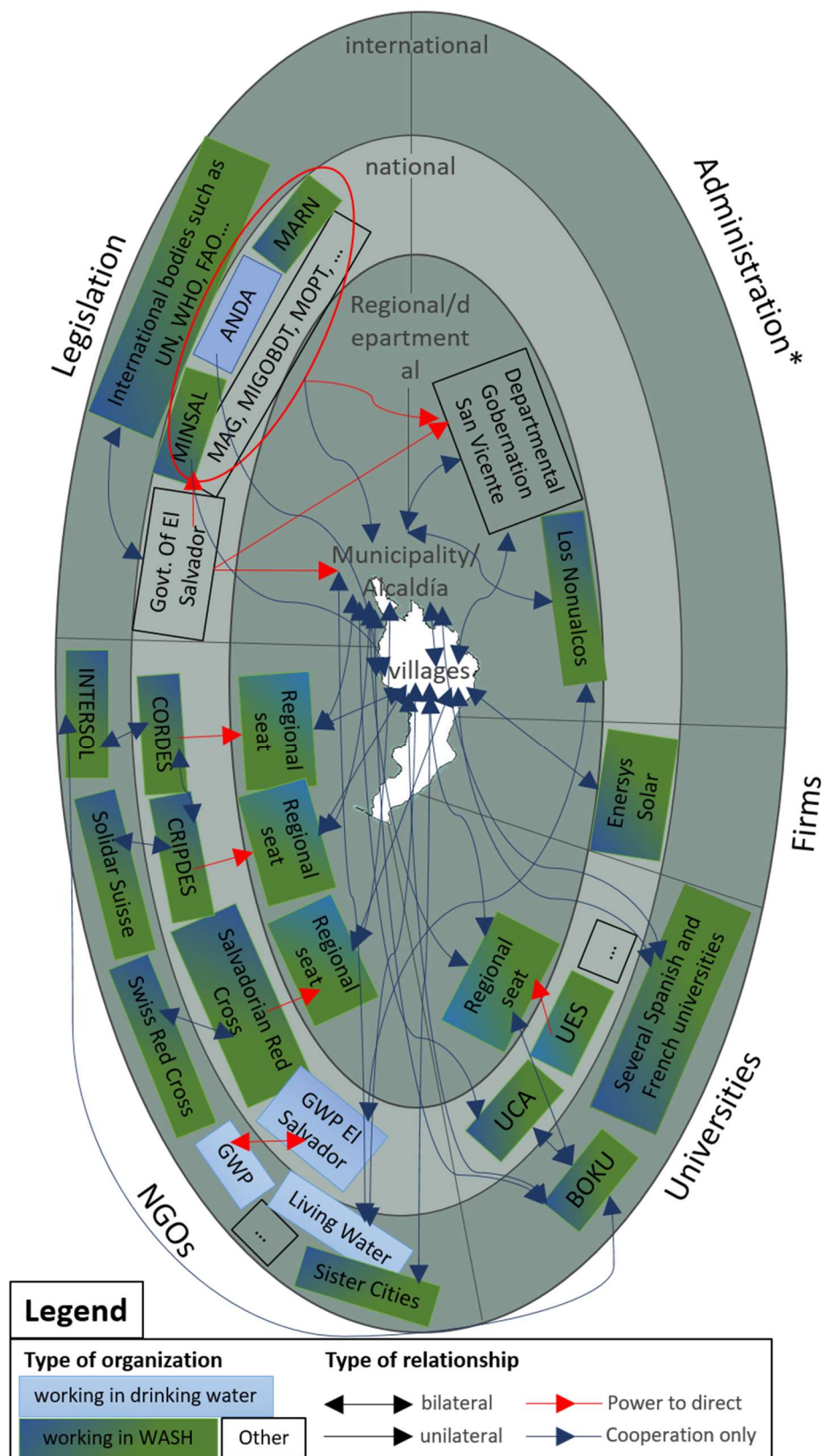
Preguntas adicionales:

- ¿Cómo le fue en la colaboración con los investigadores de parte de la BOKU?

Preguntas finales

- ¿Usted me podría dar los contactos de organización XXXX?

- ¿Usted me podría compartir sus trabajos científicos/datos/resultados que usted ha realizado en respecto al agua/saneamiento?



*COMURES/CDA have been left out, as they are merely consulting bodies with little work directly in WASH.

Figure 13 Network of stakeholders in WASH in Tecoluca at international, national, and regional level

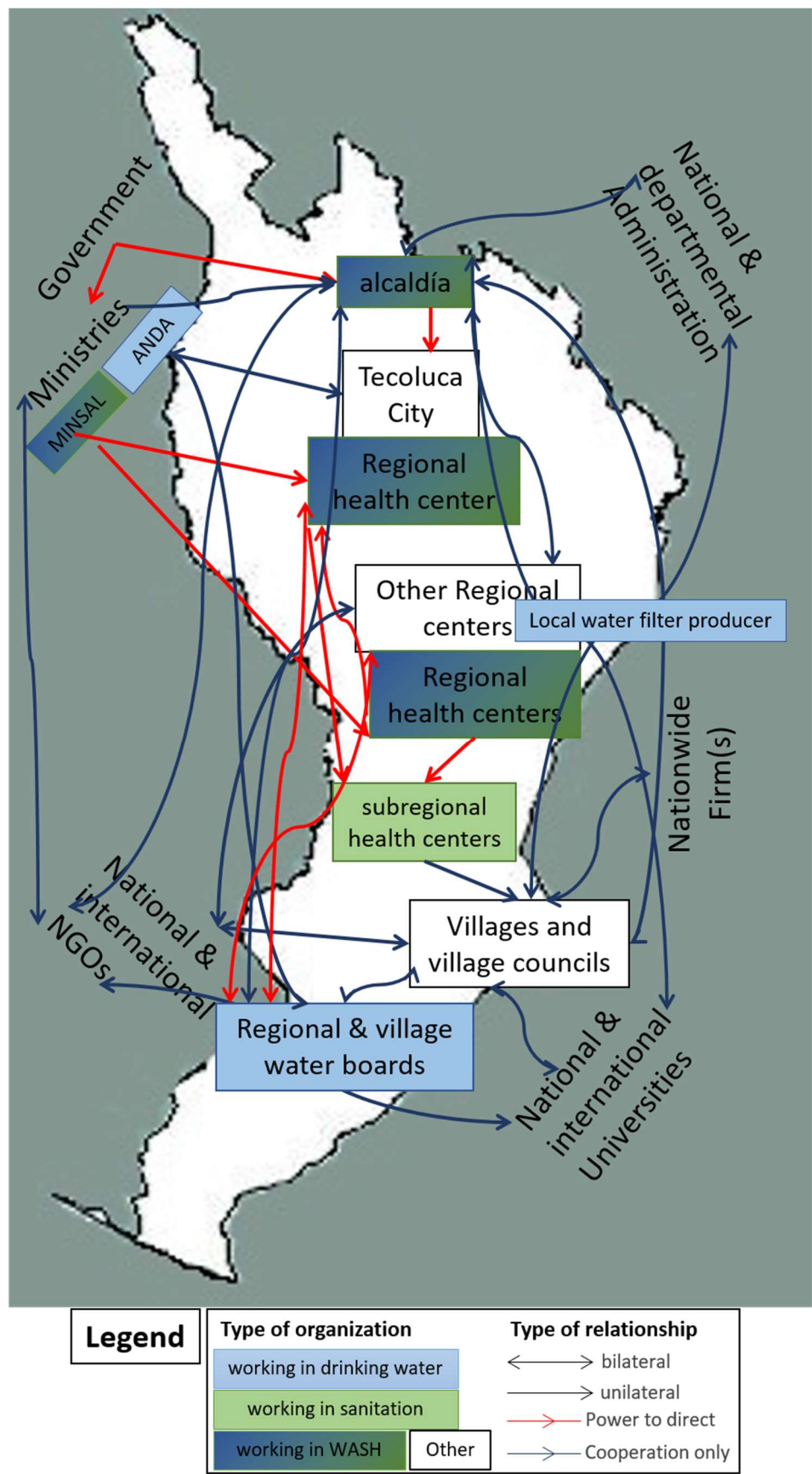


Figure 14 Network of stakeholders in WASH within the municipality of Tecoluca

10.5 Working Tips for Students

Table 10 'Working Tips' for the students in the organization of their work

	Mentioned frequency	% of mentions
'Go with the flow', spontaneity	12	75
Finish the thesis quickly	1	6
Write and send applications for permission as soon as possible	1	6
Stay realistic in what can be achieved	1	6
Good data documentation	1	6
Total	16	100

Table 11 'Working Tips' for students in the cooperation with other stakeholders

	Mentioned frequency	% of mentions
Be persistent	6	60
Call before meetings to confirm	1	10
Communicate with communities without cell phone reception via official note	1	10
Ask for data at once/make own copies	1	10
Patience	1	10
Total	10	100

11 Curriculum Vitae

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Oct. 2013 - Oct. 2016	University of Natural Resources and Life Sciences Vienna (BOKU) Bachelor program Environmental and Natural Resources Management
July 2014 – Nov. 2014	Universidad Nacional de Costa Rica Exchange semester
June 2012	Bundesoberstufenrealgymnasium Deutschlandsberg

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March 2019 – June 2019	Field Work in Tecoluca, El Salvador For the Master's thesis Assessing BOKU WASH research
April 2015 – Oct. 2015	Institute for Transport Studies, University for Natural Resources and Life Sciences, Vienna Independent Contractor for the Project SWITCH
July 2015 – Sept. 2015	Waste Management Association Deutschlandsberg Internship
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July 2012 – July 2013	Voluntary social gap year In Longo Mai, Costa Rica
Jul. 2011 – Aug. 2011	Roche Diagnostics Graz GmbH Internship in the HR department

12 Affirmation

I certify, that this master thesis was written by me, not using sources and tools other than quoted and without use of any other illegitimate support.

Furthermore, I confirm that I have not submitted this master thesis either nationally or internationally in any form.

Vienna, 30.05.2020

Lena Ortega Menjivar