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Barriers to Sustainable Water Management in the Agricultural Sector in Andalusia: A Grounded Theory Approach

By

Vivien Eileen Meier

A thesis submitted for the Joint Master degree in
Global Economic Governance & Public Affairs (GEGPA)

Academic year
2020 – 2021

June 2021

Supervisor: Dr. Robert Isaak

Reviewer: Marco Margheri

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Abstract

This dissertation investigates the barriers to the sustainable development of an agricultural water system that is failing and potential solutions to overcome them. Although this work focuses on the Spanish region Andalusia, it represents a prime example as it is one of the most severe cases of water scarcity in Europe, with an economy highly dependent on its agricultural exports and an increased cultivated area without a corresponding improvement of its water management. Therefore, most of the findings can also apply to other regions in the world affected by water scarcity. On the basis of grounded theory, expert interviews have been conducted with stakeholders of different backgrounds in this field. It was found that the main obstacles to a sustainable water system are a lacking knowledge exchange among stakeholders, which causes wrong decision making and mismanagement in agricultural water management. A policy and legal framework exist which favours an unsustainable, growth-oriented food system, while the dynamics of capitalism, financial allocations, the norms of society and the strong lobby of irrigators play central roles in this regard. The existing laws on water protection provide a basic foundation, but sufficient implementation mechanisms and ambitious environmental protection are missing. As a potential solution, a more inclusive discourse between the stakeholders was emphasized, for which, however, the necessary framework conditions must be created first. In order to realistically implement sustainable development that protects water as a natural resource, an interaction between the stakeholders will be required, while each individual stakeholder actively commits to use his or her scope of action to achieve a positive transformation. Another potential lies in further research aimed at redesigning current alternative water sources and linking them to sustainable concepts of energy supply and waste solutions.

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CAP	Common Agricultural Policy
COVID	Coronavirus Disease 2019
EEA	European Environment Agency
FAO	Food and Agriculture Organization of the United Nations
NGO	Non-governmental organisation
SDG	Sustainable Development Goals of the United Nations
UNCCD	United Nations Convention to Combat Desertification
WEF	Water-Energy-Food nexus

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Introduction

With a worldwide growing population, the demand for water increases as well. The resulting changes, which are expressed as resource scarcity and environmental damage, and which are driven by activities of increasing, out-put-oriented agriculture, are simultaneously intensifying the pressure on the food industry: On the one hand, sufficient yields must be generated for the domestic and international market. On the other hand, it becomes even more important to protect limited resources and to build a sustainable food system that is not only profitable but also environmental-friendly and ethically acceptable.

More than a quarter of the global population is affected by high water stress, a number that continues to rise due to growing demand and changing climatic conditions (UNFCCC, 2020). Agriculture is by far the largest user of water and is also directly affected by water scarcity. Therefore, effective measures must be taken specifically in this sector, as without water, harvests would be drastically reduced, and food security would no longer be guaranteed. (FAO, 2012)

The water crisis is also becoming increasingly serious in Europe. As the EEA states, this part of the world is developing towards a tipping point, where a dynamic is reached at which a negative development runs by itself. This makes it even more urgent to act effectively as quickly as possible and to reduce the consumption of natural resources in a controlled manner in order to prevent irreversible consequences of climate change, from which nature will not be able to recover. It also describes that the necessary knowledge and technologies are already available. (EEA, 2020)

Despite these conditions and developed legislation, the question arises why sustainable development has not been achieved for the most part in agriculture so that the environmental goals of international agreements are not being met and water continues to become scarce.

To address this question, the author's two hypotheses and their sub-hypotheses are tested using the grounded theory methodology. These are as follows:

Hypothesis1: The main barriers to the sustainable development of a water system that is failing concern the consciousness of the stakeholders, the policy and legal framework, as well as the legal enforcement.
Subhypothesis1: Lacking knowledge dissemination among stakeholders on sustainable development causes wrong decision making and mismanagement in agricultural water management.
Subhypothesis2: The non-inclusive policy and legal framework favour an unsustainable, growth-oriented food system.
Subhypothesis3: Insufficient implementation mechanisms of laws on water protection make their existence irrelevant.
Hypothesis2: Solutions to mitigate barriers to a sustainable water system lie in the inclusive discourse and exchange of knowledge about sustainable development.

By testing these hypotheses through the inclusion of expert narratives, the paper aims to explain which causes and drivers exist for this serious situation in the agricultural context, what positive developments already take place and which opportunities are available to overcome the barriers to sustainable development.

For this purpose, past literature is first integrated to explain the general situation of the water crisis. In particular, the expertise of international organisations, such as the FAO and OECD, has been integrated, as well as previous works focusing specifically on the case of Spain and Andalusia, and publications by the local government and the EU. Based on the grounded theory, the classical definition by Glaser & Strauss (2010) and the modern application in social research by Heiser (2018) are used in the main part.

This study focuses on the period from 1960 to 2050. While it will not deal with the history of the water system, it is still essential to have a brief look at its origins and the development of local water management and infrastructure over the last decades. To further narrow the research question, the central topic will be water use. Other factors, such as water contamination by agricultural activities, are not dealt with in-depth, although they are relevant aspects that influence water quality.

As most of the presented information concerns Andalusia, the situation in other countries and regions may differ. Nevertheless, the area in southern Spain is highly

representative, as it is one of the most severe cases of water scarcity in Europe. With this acute example, existing barriers, as well as potential opportunities for improvement can be clearly indicated. A positive change in this region could function as a model example, which other regions can follow and initiate a development at an early stage.

At the beginning of the present thesis, the key terminologies are outlined. These provide a rough framework around the concept of sustainable development and the water crisis, within which the subsequent analysis takes place.

In the following chapter, the case of water scarcity and its external influences are presented. Here, the global situation is shown first and then focused more specifically on Spain, using the region of Andalusia as a particular example. In addition to the local geographic and climatic conditions, the practices in agriculture and water management are shown, as well as previous attempts to structure the latter in a sustainable way.

The next chapter describes the methodological procedure of the research. After an insight into stakeholder theory, which highlights the importance of integrating different narratives, the grounded theory is explicitly elaborated. A linear explanation of the individual steps provides a transparent and comprehensible overview of the complex methodology applied.

Building on the basic knowledge of the topic and the analytical process provided up to this point, a presentation of the empirical findings is given. This part represents the heart of the present research. Here, on the one hand, the established hypotheses are tested and, on the other hand, an analytical story about the core barriers, their causes and consequences are created through the integration of the different narratives. By using first-hand information from various experts in this field, it is intended to fill the knowledge gap of literature-based research.

Also based on these narratives, the fifth chapter shows potential solutions and explains which actors can enable sustainable development in agricultural water management in the short or long term and how these solutions can be implemented not only in Spain but also worldwide in regions affected by water scarcity.

In the conclusion, the most relevant research results are summarised, and the hypotheses reviewed. This will be rounded off by ideas for further research.

1. Explanation of the key terminology

a. Sustainable agriculture

In order to understand the desired outcome of the subsequent analysis, the concept of sustainability should be explained first in the context of agriculture. As in many other cases, there are various definitions of 'sustainability' available in the literature. The World Conservation Union IUCN (1991) uses the expression to refer to "improving the quality of human life while living within the carrying capacity of supporting ecosystems" (p.10).

Most concepts measure sustainability by the variables of society, economy, and environment, often referred to as the triple bottom line framework. Its central maxim is to create a system that is "environmentally sound, socially just, [and] economically prosperous". (Hamline University, 2015, p.1) In accordance with this description, indicators of each dimension are interlinked with one another and result in a respective level of sustainable development.

Some attempts have been made in the past to identify factors that help to determine the level of agricultural sustainability as they have an impact on farming practices. These factors, to name but a few, include the use and quality of water, soil, and land, the input of pesticides, generated output, as well as financial resources. Because of their strong interrelation, a change of one variable can ultimately lead to a direct or indirect change of other variables. Moreover, they can be influenced by the external environment and society and simultaneously influence them, which supports the concept of the triple bottom line. (Takigawa, Noguchi, & Ahamed, 2015) In the further course of the study, the importance of this basic concept is continuously emphasised.

b. Sustainable development

Before examining the barriers in the later research, it is essential to understand the basic concept of sustainable development. Its most widely used definition is the one of the Brundtland Commission, in which it has been described as a concept of meeting

the needs of current and future generations. Its key element represents the unity of environment and development, meaning that these variables are inseparable. The concept of this very first definition of sustainable development was further developed until legally binding agreements were created that set ambitious environmental goals. (European Parliament, 2020)

Looking at the global transformation of the food system over the last century, it is clearly visible that despite major changes of processes, there has been a trend towards deterioration in sustainability. (Göpel, 2016) These processes are characterized by the strong focus on economic growth, which appears increasingly questionable, as endless growth in a closed system as the world with limited resources is not feasible (Meadows, Randers, & Meadows, 2004).

This situation of continuous growth despite limited resources is often referred to as the 'growth dilemma'. It has severe impacts on nature and causes, among other things, unemployment and uneven wealth distribution within societies. (Jackson, 2009)

Several political events took place in the past that have been crucial to integrate environmental matters in policy and to start creating a legal framework for it. Just to mention a few of them, the Brundtland Commission, the subsequent Earth Summits, the Paris Agreement, the Green New Deal, and European Climate Law have been important steps. (European Parliament, 2020) Despite these efforts, a state of sustainability for society, environment, and profitability has not been achieved yet (Göpel, 2016).

However, as a state of sustainability remains widely unfulfilled, the current actions lead to resource scarcity. This again is an accelerator for conflict, violence, and famine and prevents both human and sustainable development (UN System Task Team on the Post-2015 UN Development Agenda, 2013). Therefore, it seems essential to identify the barriers to sustainable development in order to dissolve them effectively.

c. Water stress, scarcity, and risk

According to the UN (2018), about 2 billion people live in water-stressed regions. With the current volume and system of water use and additional factors such as climate

change and increasing water demand of a growing population, this number is expected to increase further.

Agriculture represents the most extensive utilizing area of water and is simultaneously its major polluter. In order to ensure sustainable and efficient food production and to prevent expanding desertification, improving water management within the agricultural sector is essential. (United Nations, 2018)

Although 'water stress', 'water scarcity', and 'water risk' are often used as synonyms for each other, it is essential to differentiate these terms for a more comprehensive overall understanding.

A broad definition falls under the term ‘water stress’, which expresses the inability to meet the water demand for people and ecosystems. It includes a number of factors for the assessment of water, such as its quality, accessibility, but also scarcity.

‘Water scarcity’ is a more distinct definition that expresses the lack of water supply in terms of volume and its relation to human water consumption. Next to other factors, like pollution, insufficient infrastructure, and management, it can lead to water risk.

Other than the aforementioned ratios, ‘water risk’ expresses a probability, namely the likelihood of the occurrence of a threat due to diminishing water. Its impacts can vary among sectors, despite facing the same level of water stress or scarcity. Therefore, each entity has to define and evaluate the factors relevant for it in order to calculate its specific water risk. (Schulte & Morrison, 2014)

Altogether, their combined existence on all continents and their severe impacts have been defined as the biggest threat of the current decade as outlined in the Global Risk Report 2019 by the World Economic Forum. (World Economic Forum, 2019)

The water crisis that is explicitly addressed in this research refers to water scarcity. Globally, it is proven to be caused by humankind and, to this extent, is not a natural occurrence in nature. It is the direct result of insufficient planning, no large-scale

implementation of adequate technologies, inaction, and postponement of transformative activities. (Sedlak, 2014)

2. The impact of key areas on the global water situation

a. Water scarcity in the world

Water is a unique commodity that cannot be substituted. It is essential for the lives of human beings, as well as for animals and ecosystems. There are about 1,260 million trillion litres of water in the entire world. 97% of it is salt water. Freshwater accounts for only 3%, whereby a large part is in a frozen aggregate state, which makes it only 1% of global water that can be used for human kind. (Roman, 2020) 0.3% of this freshwater is categorized as surface water such as rivers or lakes. The rest is groundwater that requires a certain infrastructure, knowhow, and monetary funding to extract, distribute, and process it. Technological developments of the last decades enabled easier water access. However, this advancement also had its drawbacks. Although aquifers are a useful water source in dry seasons, when they become the only source for water supply and are prevented from regeneration, they dry out. (UNESCO, 2021)

Additionally, as groundwater extraction changes the pressure conditions, this causes soil compression. This kind of degradation of the soil structure does not only result in a decrease of the soil level but also in nutrient and moisture loss and poorer conditions for plants and microorganisms to grow. (Nawaz, Bourrié, & Trolard, 2013)

The global population is expected to exceed the 9 billion mark by 2050. By then, agriculture will have to be adjusted to meet the demand for water and food despite the constraints of diminishing resources and shrinking land due to increasing urbanisation. (FAO, 2017) Although the lifestyle and eating habits of this increasing population have changed and tremendously grown, the global water management for agriculture has not developed accordingly and became largely outdated (IAASTD, 2009).

In addition to a population increase, water use has been one of the strongest accelerators of water scarcity. While 8% of annual freshwater use is consumed by households and another 22% by industry, with 70% agriculture represents the biggest

utilizing area of water and is simultaneously its main polluter. In order to ensure sustainable and efficient food production, improving water management within the agricultural sector is essential. (OECD, 2008)

Nevertheless, water for farming activities is sold at an exceptionally low price (Castel, et al., 2006). In comparison to industry and households, the agro-sector only pays a marginal amount per cubic meter which makes it less urgent and inciting for farmers to improve their proceedings (Laudicina, 2018).

During dry seasons, additional irrigation is necessary for many regions of the country to sustain plants. Commonly, intensive drilling and pumping of aquifers and groundwater provide irrigation of fields and for livestock grazing and -production. As more water is used than replaced by rainfall (Rhoda & Burton, 2010), as well as the fact that the amounts of irrigation water usage are more than twice as much as irrigation required (FAO, 2016a), over-exploitation of water resources exists and represents a threat to sustainable water supply and thus to food production as well (Rhoda & Burton, 2010). In comparison to the global average, less crop can be produced by spending relatively higher amounts of water (AgroDer, 2012).

Besides irrigation purposes for crops, livestock and animal produces require large amounts of water. Within its scope, many different steps must be considered. These cover, among others, the irrigation of fields for fodder production, drinking water, stable washing, water input within production processes such as washing, boiling, or cooling and pasteurizing as well as cleaning instruments and slaughter spaces. (UNCTAD, 2014) Despite requiring large amounts of water, the output per water unit is not accordingly high (Castel, et al., 2006).

With an increasing demand for animal-based products, mismanagement of resources exists. According to Pimentel (2004), about 3,500 l of water is required to produce 1 kg of chicken. The by far highest inputs are required for beef production, whereby 160,000 l water and 160 kg fodder are used to produce 1 kg of beef. (Pimentel, et al., 2004) Since the end of the 20th century, there has been a rapid expansion of livestock production, which lead to a reduction of plant cultivation. Also, former acres for

growing crops for human consumption have been displaced by fodder crops. (Améndola, Castillo, & Martínez, 2005)

As freshwater becomes increasingly scarce, alternative water sources gain in popularity. In 2016, desalinated ocean water accounted for less than 1% of global drinking water. However, this amount is expected to increase. Currently, the desalination and filtration process to achieve drinkable standards of former brackish or saltwater is expensive and requires high energy input. With the development of technologies, it remains to be seen how the costs and environmental impact of these processes can be reduced to achieve long-term solutions for the growing demand. (Voutchkov, 2016)

At the same time, precipitation has become less reliable as climate change led to longer and more intense dry periods and to less rainfall and snow, which formerly irrigated the land and refilled waterbodies. (Green, 2016)

The environmental drawbacks coming from intense water use that lead to water scarcity can take many forms. These vary from increasing salination of water to loss of wetlands. A loss of water quality ensues diminishing water flows, as it allows a higher accumulation of pollutants and toxins, which causes an increase in algae, decrease in phytoplankton and fish population. (Strosser, et al., 2012)

Many of these symptoms are already visible in Spain: The strong water subtraction mainly for agricultural purposes leads to water intrusion, degradation of wetland areas, and its conversion to scrubland. Beyond the agricultural sector, the diminishing water levels jeopardize the provision of drinking water and hydropower generation as well as the tourism sector. (Strosser, et al., 2012)

b. The case of Spain and Andalusia

From a European and global perspective, Andalusia plays a significant role. Spain is a global leader in olive oil production (Pleguezuelo, et al., 2018) and one of the biggest producers of tomatoes, cucumbers, strawberries, and various citrus fruits (FAO, 2019). The demand for summer fruits throughout the entire year has a major impact on producing countries. About 209l of water is required to produce 1kg strawberries

(Schulz, 2020). One of the largest strawberry production regions in the world is Huelva, which faces water scarcity since many years. Its town Lucena del Puerto produces more than 40 tons of fruit per year with a market value of half a billion euros. With the closure of the illegal wells, losses of half the harvest are expected. (Bosque, 2020) Almost all of the 3,000 inhabitants fear for their livelihood as they strongly depend on agriculture that is threatened under the current circumstances (Güell & Garcés-Mascareñas, 2020).

Huelva is characterized by its large cultivation areas for strawberries, but as water sources are diminishing, water theft is a major issue, as well as sharing water reservoirs with nature conservation areas, for which the Doñana National Park is one example. The park is a World Heritage Site, a hotspot for fauna, and an important refuge for many species. The lagoon is also an important resting place for migratory birds on their route to Africa and back. (Schmidt, et al., 2016)

Building wells wherever needed has been common practice in the country. The number of illegal wells in Spain has been estimated at about 1 million, which has been broadly accepted by public authorities. (Schulz, 2020) More than 1,000 of them have been operated by farmers in the Doñana region (European Parliament Committee on Petitions, 2019).

In 2017, the wells were already classified as illegal, but it has not led to direct actions. In January 2019, the EU filed a complaint against Spain for not sufficiently protecting its groundwater. (Schulz, 2020) In the same year in July, many of the wells were closed with the help of the military police. A major factor for this decision was the case of the Doñana National Park that shares a groundwater reservoir with the regional cultivation areas, whose groundwater levels are continuously sinking. (Planelles, 2019)

Despite these actions, new solutions for local irrigation have not been presented. The affected farmers, whose only access to water has been exclusively through illegal wells, were thus dependent on the solidarity and support of neighbouring agrarians to irrigate at least part of their fields. Nevertheless, it resulted in severe losses for most of the people affected, as without water, the land could not be cultivated, no income

was generated, and thus, the livelihoods of entire villages were no longer secured. (Rosa Font, 2019) Social conflicts emerged and young people had fewer incentives and opportunities to find employment in this region (Schulz, 2020).

i. Geographical and climatic aspects

The autonomous region Andalusia stretches along the southern coast of Spain and represents 17% of the landmass of the country. The landscape is characterised by pastoral oak groves of the Dehesa in the west, the region of the Guadalquivir river, the wide plains of the Campiña in the centre, the coastal landscape in the south, as well as the Sierras Beticas that encompass the Sierra Nevada and olive groves that extend from the east across the country. (Junta de Andalucía, 2015) At the southern tip, the Strait of Gibraltar connects the Mediterranean Sea with the Atlantic Ocean, into which the Guadalquivir river flows (Templado, et al., 1993).

Half of the Andalusian landscape is forest, mostly oaks and cork oaks. This plays a particularly important role for the environment, as an annual amount of about 2.1 million tons of carbon is captured. (Junta de Andalucía, 2015) These are also important for water regulation, the formation and binding of soil, and provide a habitat for flora, fauna and animals (Loft & Schramm, 2011).

The local climate is characterised by its dry summer season, whereby the south-eastern region represents the driest area. Rainfall predominantly occurs throughout the rest of the year, mostly during autumn. However, weather conditions vary across the region as they highly depend on variables such as the proximity to the seas and the mountain ranges, as well as the atmospheric pressure areas such as those of the Azores, the Balearic Islands and the Atlantic Ocean. As a result, some areas in the southeast show a lower precipitation rate of around 150mm and further west a higher rate of over 1,000mm. (Isselhorst, Berking, & Schütt, 2018)

Figure 1: Topographic map of Andalusia with overview of the region's location in Spain. (Isselhorst, Berking, & Schütt, 2018)

ii. Characteristics of the local agriculture

Despite the extending dry seasons and the scarcity of water, Andalusia's history fostered its strong agricultural identity: About 50% of the territory is occupied by farms, most of them located in the fertile wetlands of the river and coastal regions. (Isselhorst, Berking, & Schütt, 2018)

A large part of the agricultural land is occupied by arable crops, olive groves, and permanent grassland. Fruit and wine production take up a smaller space. In terms of quantity of production, fruit, vegetables, and olive oil account for 70%. The rest is made up of livestock, cereals, other crops and legumes. (Junta de Andalucía, 2015) Andalusia mainly cultivates tomatoes, oranges and vine, but also peppers, wheat, and olives. It is also known for its strawberry and sunflower production. (Mercasa, 2020)

The north-eastern province of Jaén has the largest concentration of farms, with an average size of 10 hectares. It is followed at a distance by Granada and Córdoba. With an average size of around 22 ha, the farms are smaller than the average farm size in Spain of about 30 ha. (Junta de Andalucía, 2015)

Livestock consists primarily of horses, sheep, goats, cattle, pigs, poultry, and rabbits. The coastal region with its 38 ports is also a fishing area. More than 100 aquaculture businesses and fisheries are located here. (Mercasa, 2020)

Although conventional agriculture remains the most common practice, Spain has the largest area of organic cultivation in the EU, with approximately 2.35 million hectares, and is in fifth place in the world ranking. Almost half of this area is located in Andalusia, which is also at the forefront of organic livestock farming. (Mercasa, 2020)

Fuelled by climate change, the increasingly spreading drought causes significant crop losses, in some cases by up to 50%. In addition, there is a change in the quality, taste, and ripeness of fruit, which particularly affects the wine industry. Due to the changing seasons with longer and hotter dry seasons and disappearing spring and autumn, winegrowers are forced to restructure and resort to additional irrigation more often. (Jones, 2017) Extreme winters with temperatures below zero and intense temperature fluctuations increase the risk of crop failure, as the local crops are not resilient enough for these events (Isselhorst, Berking, & Schütt, 2018).

Andalusia is also known for its ‘Mar del plástico’ in El Ejido, Almeria. With its approximately 400km^2 (Hertrampf, 2019), it is the world’s biggest agro-industrial wintergarden and largest cultivation area under foil, which gave it its byname ‘plastic ocean’ (Luzarraga Iturrioz, 2018).

Nevertheless, its local agriculture led to massive issues and a poor ecological situation. The main issues are the intensity of the land use, the expansion of fields without official approvals (Entrena-Durán, 2015) as well as and the high application of pesticides and manure which seep into the groundwater or are flushed into surrounding water bodies and thus pollute them (Belmonte Vega, Garrido Frenich, & Martínez Vidal, 2005). Furthermore, it has been a significant driver of desertification, which concerns about 75% of the area in Spain, whereby 18% are classified at high risk (McMurtry, 2019). One of the few deserts within the EU – the Tabernas desert – is located in Andalusia, close to the mar del plástico in Almería. It has to be clarified that the Tabernas desert is not the result of overexploitation of water resources (Martínez-

Valderrama, Guirado, & Maestre, 2020) but is mentioned in this context to give an idea of the surrounding ecosystem in which agricultural activities take place.

This food system also has a major impact on social conditions. In order to be able to offer a competitive and low price in the supermarket, illegal and seasonal workers are often employed, mostly from African countries. As the social realm is very extensive, it would go beyond the scope of this paper. To provide a rough idea of the situation, it should be mentioned that due to water scarcity, these workers often have limited or no access to water for hygiene, sanitary facilities, or drinking. (Palomo, 2020) There is no sufficient labour protection, below-average salaries and particularly women, who are increasingly employed in this sector, are at higher risk to be exposed to sexual violence (Women's Link Worldwide, 2019).

iii. Characteristics of the local infrastructure and water management

Over the past decades, Spain has faced diminishing ground- and surface water reserves, while irrigation accounts for more than 75% of the country's overall withdrawn groundwater. The over-exploitation of aquifers caused water depletion, especially in the south-east of the country, including Andalusia. The wells in this region have shown significant groundwater decline. (Gelati, et al., 2020) It has also shown the most extreme cases of baseline water stress within the country (Hofste, Reig, & Schleifer, 2019). Furthermore, precipitation decreased, and the limited amount of water left in the coastal regions became saline (Jones, 2017).

Due to the shrinking reservoirs, the risk of reaching 'day zero' increases, which refers to the date on which all of the natural water resources are fully depleted. Further in the centre of the country, early warning systems have already indicated this increased risk, as the water levels of some reservoirs dropped by 60% in five years. (Watts, 2018)

Most of the irrigated farmland is supplied by surface- and groundwater. Other sources such as processed sea- or wastewater represent a marginal amount. (Isselhorst, Berking, & Schütt, 2018)

In order to provide water, a certain infrastructure and management are necessary. This concerns the entire process of subtraction, storage, transport and distribution. To access groundwater, the traditional ‘galería’ technique is often used, managed by irrigation communities. This involves digging a tunnel at upslope aquifers, which first directs the water to a catch basin before it is distributed from there to smaller artificial reservoirs for storage. The water is then piped to the fields through a connected canal system. (Isselhorst, Berking, & Schütt, 2018)

Large parts of the Spanish water system date back to Roman times when it has been an innovation to transport water to places that did not have direct access to it. Although the ancient system went through series of transformations, the influence of the Muslim Period and the Moors have been very strong in this region. Hence, their systems still represents the basis for the country’s water management structure of today. (Isselhorst, Berking, & Schütt, 2018)

A considerable turning point has been the Water Act in 1985. Through its adoption, surface water and ground water bodies received the status of a public good, with an exception for water bodies that have been privately owned before the implementation of the act. (Isselhorst, Berking, & Schütt, 2018)

The high complexity of water management is attributable to the large number of corresponding regulations. Thus, in some parts, there is a centralised management of large basin-based systems controlled by the government, and in other areas a decentralised management of smaller systems for which local institutes or private institutions are responsible. (Isselhorst, Berking, & Schütt, 2018)

In Andalusia alone, there are 586 irrigation areas. These are managed by the mostly private irrigation communities, the ‘Comunidades de Regantes’. Each of these communities is of a different size and has different requirements for access to water, which is used for different agricultural products. Their management depends on the local law that applies to the land, the water and the respective ownership. (Isselhorst, Berking, & Schütt, 2018)

There are two types of systems: Syrian and Yemenite. In the Syrian system, land ownership includes authority over local water access and thus responsibility for water distribution. In the Yemenite system, land and water ownership are separated and sold independently. (Isselhorst, Berking, & Schütt, 2018)

The distribution method within the Comunidades de Regantes also varies. The auction method is applied in rare individual cases in the south-eastern region towards Murcia but has largely been overtaken by other approaches. In the rotation method, water for irrigation is distributed to farms either at a certain time window or in a fixed quantity in the rotation order. In the on-demand scheme, farmers can register for access to irrigation water according to their needs. (Isselhorst, Berking, & Schütt, 2018)

Particularly the distribution of surface water, such as that of large rivers like the Guadalquivir, which is bordered by several areas that need to be supplied, requires a high degree of sophisticated management. The distribution of groundwater is comparatively less complex in its administration processes, as the areas depending on it are usually smaller. (Isselhorst, Berking, & Schütt, 2018)

On average, the Andalusian irrigation areas comprise at least one spring that supplies either one or several cooperating irrigation communities. Most commonly, these include an irrigation area of a maximum of 100ha belonging to several hundred farmers. (Isselhorst, Berking, & Schütt, 2018)

Water plays an essential role for the economy and society. Thus, the developments regarding its availability and quality have a big impact on the state of both variables and vice versa: Structures and changes in the economy and politics can also have an impact on the management of water. In recent decades, for example, large water allocation programmes - which were set up because of the unequal distribution of water - have led to the dismantling of self-management systems. Although half of the areas to be irrigated have a positive water balance, their water demand is more than 40% greater than the natural resources available. (Isselhorst, Berking, & Schütt, 2018)

There exist eight different irrigation systems, which are categorised according to their geographical location, type of use and economic significance. In addition, irrigation

can be subdivided into further types. Drip irrigation has been the most common method for a while as it is used especially for olive cultivation and for water-intensive foods. Since the beginning of the 2000s, the most common type is surface irrigation, which is used especially for rice cultivation and in the regions along the Guadalquivir, in Jaen and in south-eastern Andalusia. In addition, there are sprinkler systems, which are mainly found in Cadiz and in the zones along the river Genil. (Junta de Andalucía, 2015)

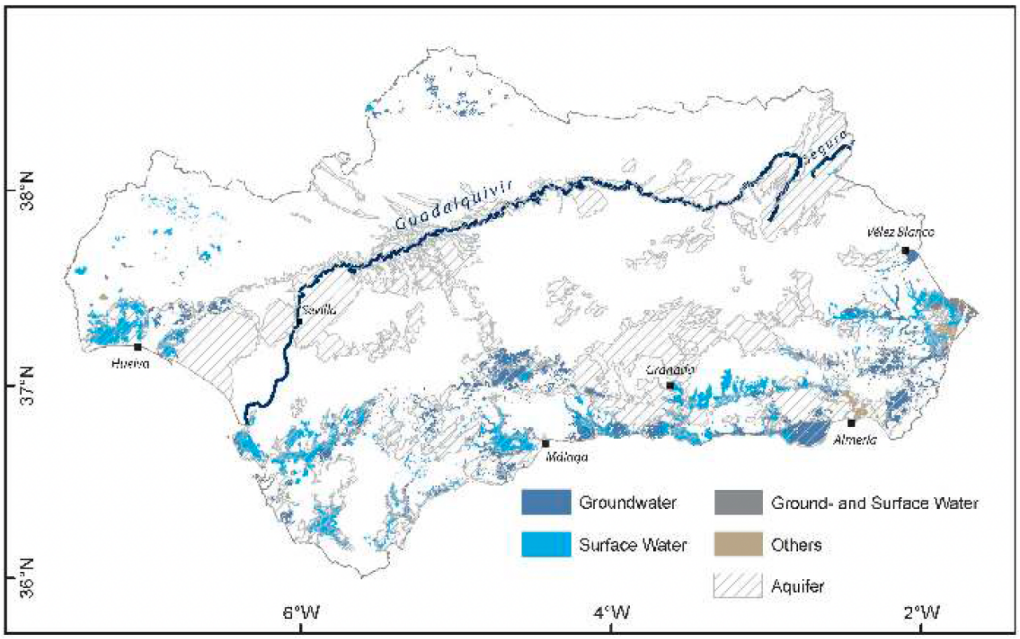

Figure 2: Map of irrigated areas and water sources in Andalusia (Isselhorst, Berking, & Schütt, 2018)

Water-intensive agricultural activities include greenhouses, rice cultivation along the Guadalquivir, and the cultivation of vegetables, crops, maize and sugar beet. Due to the growing demand, there has been a strong increase in irrigated areas. In particular, the high water-demanding greenhouses, strawberry and citrus fruit cultivation were expanded. The province of Granada in the southeast has a long tradition of irrigation due to its dry environment, which has increased with the agricultural development. (Junta de Andalucía, 2015)

The minimal amount of water that is needed to ensure harvests is in most cases not given, which makes it necessary for the farmers to use additional irrigation. Although the precipitation per year might enable a minimum amount of harvesting without additional irrigation, this varies depending on the season and also from year to year. Especially in the prolonged summer season, more water is needed.

Vegetables, fruits and drupes require an annual precipitation of 350-900mm on average. However, independent from the type of crop, the natural water supply does not represent a reliable source which makes intensive irrigation necessary. (Isselhorst, Berking, & Schütt, 2018)

Next to water and food supply, energy is a significant factor in ensuring a healthy state of the economy and society. The water-energy-food (WEF) nexus describes the interdependence of these particular elements. For Andalusia in particular, it was found that the factor of energy costs is strongly interlinked with agricultural performance indicators and water consumption. The group map in Figure 2 by Martinez, Blanco and Castro-Campos (2018) visualizes the strong interrelation of water, energy, agriculture, land, climate, environment, society, policies and governance.

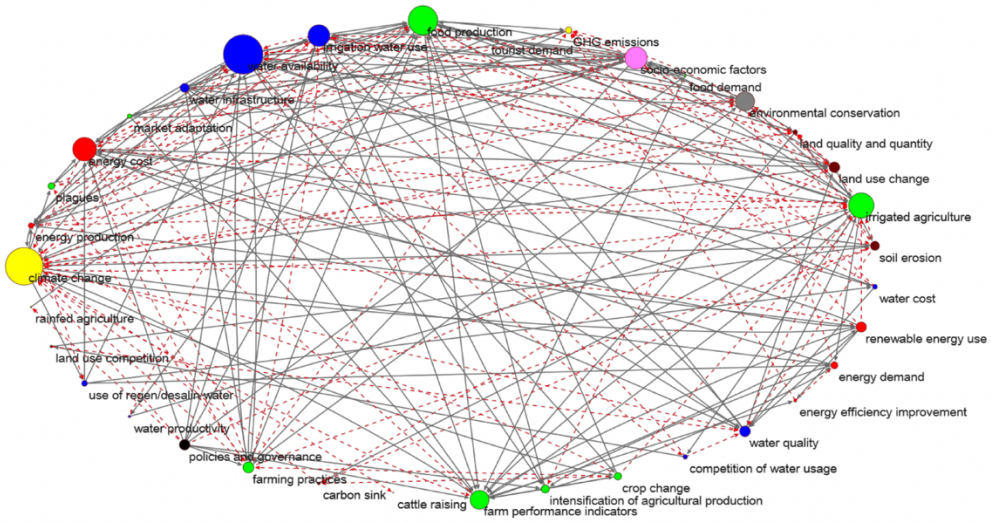

Figure 3: Group map of the WEF nexus. Each circle represents one variable within the nexus, whereby the weighting is indicated through its size. The colours are used as follows: water (blue), energy (red), agriculture (green), climate (yellow), socioeconomic aspects (pink), land (brown), environment (grey), policies and governance (black). The lines indicate the causal relationships between the variables while grey represents positive and the dotted red lines negative ones. (Martinez, Blanco, & Castro-Campos, 2018)

iv. Attempts towards sustainable water management

Efforts have been made on both national and regional level to save water by implementing new irrigation plans for the agricultural sector (Martinez, Blanco, & Castro-Campos, 2018). The EU has set a clear direction and established both short- and long-term plans to improve water use, especially in agriculture. The directorate general AGRI deals with water use within the CAP, of which sustainability is an essential part. In addition, EU research and innovation funds, such as the Horizon2020 project, support projects with new technologies and improved water supply. (DG AGRI, 2017)

The CAP comprises two pillars: the European Agricultural Guarantee Fund and the European Agricultural Fund for Rural Development. The Guarantee Fund is granted 75% of the total CAP money, which is distributed to farms as an area payment. The Agricultural Fund, to which the remaining 25% are allocated, specifically supports organic farming, disadvantaged areas and measures to protect the environment, nature and the climate. Despite the already decreasing share of the total EU budget, the CAP is planned to receive less money in the future. This financial reduction will be distributed unevenly across the two pillars, whereby approximately one-third of the funding will be cut for the agricultural fund. (Heinrich Böll Foundation, 2020)

Despite its multiple amendments, the CAP remains highly debated. In particular, the sustainability aspect plays a major role in this discussion. Critics, mostly representatives of environmental and development organisations as well as smallholder associations, claim that it primarily focuses on stabilising agricultural income without adequately addressing the challenges of the 21st century, which are sometimes only touched upon in subclauses. Furthermore, they point out that only a small expansion of organic agriculture is planned and that no measures or programmes are integrated that lead to a significant reduction in the use of pesticides.

The EU commission used to support direct investments for agricultural policy, these have been abolished in 2021, and instead, individual agri-environmental programmes of the member states are supported, which are in cross-compliance with certain ecological criteria.

With 43.8 million euros, which are planned for the period 2021-2027, Spain receives the second-largest amount of financial transfers in support of agriculture from Brussels, right after France. Its monetary distribution, however, is viewed critically, as farmers receive support based on hectares instead of being tied to specific results or goals, and an imbalance arises, as farms are supported that earn an above-average income even without the aid. Due to the area payment, 80% of the money is distributed to 20% of the beneficiaries. (Heinrich Böll Foundation, 2020)

Spain has by far the largest biological agricultural area within the EU, although this area only amounts to 5-10% of overall cultivated area in the country and its production

does not meet the increasing demand for it. Also, honouring the environmental performance of this economic method does not belong to the current priorities of the EU.

This is also reflected in the regulations regarding overfertilization, which is not properly integrated within the EU's agricultural policy. Although the EU has set ambitious targets for pollution reduction from agriculture, concrete measures and supporting programmes are lacking, as well as the response from member states. Especially water protection management maintains to be a challenge due to the lack of coordination and a low number of controls. According to EU law, only 1% of the farms receiving subvention are required to be controlled, and in case of non-compliance, the subventions for them are shortened by 5%.

The UN Sustainable Development Goals (SDGs) are also not fully met by the EU's agricultural policy. Large-scale pesticide contamination of water bodies and intensive domestic and international water use are two main examples in agriculture that cause environmental damage in opposition to the SDGs. (Heinrich Böll Foundation, 2020)

Regionally, Spain has implemented a wide range of water regulations. The most relevant one is the national Water Act, in which environmental river flows are outlined that aim to secure a minimum amount of natural fish stock and vegetation. It also underlines the importance of sustainable use of shared water bodies with Portugal and states that the hydrological plans must consider the allocation and reserves of water for current and future generations and the security of ecosystems and nature. Furthermore, it covers entitlement of water use, although each river basin authority is responsible for the respective water allocation, entitlements and pricing. (OECD, 2015)

In the short term, many of these efforts came to fruition to a certain extend. However, it is expected that these plans lead to a non-sustainable result in the long-term, as the improved infrastructure of water systems and higher water supply increases the crop quality, which again increases the demand for them and, thus, also the demand for water. As an additional driver, the CAP payments support a system in which agricultural output is adapted to the market, which incentivizes a water-intense

production to meet the increasing demand which simultaneously causes further environmental damage. (Martinez, Blanco, & Castro-Campos, 2018)

The new irrigation plans include a conversion of the old surface- and open pipe systems to pressure technology, which in turn requires more energy. The higher energy demand, additional maintenance costs and the liberalisation of the energy market in the early 2000s increased irrigation costs. Thus, energy is one of the core factors for increased irrigation. Despite the availability of water, farmers are increasingly using deficit irrigation when energy demand is high (Martinez, Blanco, & Castro-Campos, 2018), which refers to the "application of water below full crop-water requirements" (Feres & Soriano, 2007, p.147).

3. Methodology

a. Stakeholder theory

The stakeholder theory is a classic example from economics, which refers to several constituencies that are influenced by a business entity and have an influence on it themselves. In a company, for example, a distinction is made between internal stakeholders, such as employees, managers and owners, and external stakeholders, such as suppliers, government, society and other actors. (Friedman & Miles, 2006)

According to Mitchell et al. (1997), their attributes include power, legitimacy and urgency. Here, 'power' stands for the degree of strength with which an individual or group can assert its opinion on others; 'legitimacy' stands for certain structures and behaviours that are accepted and expected by the general society; 'urgency' refers to the degree of temporal sensitivity and potential risk of the individual claims of the stakeholders. (Mitchell, Agle, & Wood, 1997) Nevertheless, as there are many definitions in the literature, the term 'stakeholder' can also be used in other situations (Miles, 2012).

In this case, stakeholders refer to relevant narratives for the research question about the barriers to sustainable water management in the agricultural sector in Andalusia. The importance of narratives in both the economic and political spheres is described by Shiller. According to him, narratives are essential for assessing and anticipating

economic events and future risks. Hereby, neither the weighting of narrators nor the probability of the statements are relevant, but that they have a space to unfold, are heard and noticed. Through the collection of a variety of narrations, recurring statements can be identified over a period of time, so that a certain consistency and coherence emerges from these narrative patterns. This dominant narrative then indicates the probability of events occurring in the future. As an example, the more negative the statements and feedbacks are, the greater is the chance of a recession. In this way, feedback loop mechanisms should help to recognise potential crises more quickly and respond accordingly. Additionally, stories of a high contagion rate reveal changes in the society's mindset and are therefore major accelerators for economic events. (Shiller, 2000)

Especially within the WEF nexus, it is essential to integrate several perspectives of actors who are directly affected in order to be able to represent them and guarantee political legitimacy. (Martinez, Blanco, & Castro-Campos, 2018)

b. Grounded theory

In order to include the different narratives adequately, the author has chosen to apply the grounded theory. As the name already indicates, grounded theory aims to develop new theory through the collection and analysis of empirical, qualitative data. Theory building is done inductively by first collecting the data and then analysing it to be able to conceptualize it into a theory using category building and other comparative techniques in a next step. Hereby, the strategy for data collection and data analysis is flexibly selectable. In this case, interview-based data collection has been chosen in order to enable impromptu narrations and to ensure the actuality of the perspectives. (Charmaz, 2001)

Before explaining the structure of grounded theory in more detail, it should first be mentioned that it is a methodology and not a method. While a method usually follows clear research rules, methodologies refer to the theoretical background of methods. By offering arguments for their legitimacy, they enable the theory-based justification for the application of the selected methods. (Strübing, 2013)

Unlike journalistic interviews or free interpretations, methodologies take place in a scientific context because they have a reflective function in the data collection and evaluation of methods. Therefore, arbitrary or false statements about reality are reduced. (Kleemann, Krähnke, & Matuschek, 2013) This type of reflection represents the core of grounded theory in particular. Its style involves qualitative data analysis and enables the development of concepts through its recognition of characteristic attributes. (Strauss, 1994)

Due to the confined scope of this dissertation, the aim is not to create a new theory, but to test the introduced hypotheses. It is intended to be a lens through which a sub-area of reality is viewed and which allows for a continuous process, as new data can constantly be collected that could raise new aspects. Although the theoretical saturation could be further exhausted in this work, the data is still significant. Increasing the quantity of data would not negate the data collected so far, as these are momentary snapshots of personal perspectives on questions to which there are no right or wrong answers. An expansion would allow a more thorough view as more perspectives are considered. These can fill gaps, reveal more intersections of the statements and lead to additional categories or clarifying existing ones. The central focus, however, remains the quality of the data, as its fullness and richness are necessary for the final analysis.

An advantage of this methodology is that the data collection and analysis follow a logical sequence and that errors or inaccuracies in the hypotheses are detected through codified steps. Particularly typical attributes of grounded theory are the early creation of categories, the analytical writing after coding, and the use of sampling for idea development. It is also subject to comparative methods that allow one to create a new theory or to test a theory.

By following the structure of coding and categorizing from the very beginning of simultaneous data collection and analysis, and intervening as little as possible in the interview, it mitigates following preconceptions of the researcher and interviewer. A constructivist grounded theory acknowledges that the observer is biased by prior knowledge, biography and interests. While this bias is transferred to his or her

interpretation and absolute objectivity is not possible, it does provide an interpretive rending of real events. (Heiser, 2018)

In terms of data collection, classical qualitative guided expert interviews were chosen for this study. This classical method allows access to knowledge of the respective expert. (Gläser & Laudel, 2012) With regard to data analysis, the style of grounded theory enables an analysis of a broad spectrum of data and objects of investigation (Heiser, 2018).

For this study, grounded theory was deliberately chosen as the methodology because it allows integrating all relevant stakeholders in this case. It helps to break down a complex topic such as barriers to sustainable development in agricultural water management, to re-arrange the individual parts, to present them in a structured form and finally to test the hypotheses. For both experts and laypersons in the field, it draws a comprehensive and comprehensible picture of what the causes and basic conditions of a problem are, how people respond to and cope with this situation and to which consequences it leads.

i. Research design

The main components of grounded theory are theoretical sampling, comparison, memos and coding. In theoretical sampling, data is collected through interviews. For these, specific cases are selected, in this case, stakeholders who are relevant to the research question and hypotheses, and whose narrative is recorded. The continuous formation of the sample sensitises the researcher to which further narratives might be relevant based on the initial research results and which data are of higher significance in order to be able to analyse them in more depth later on.

For the comparison, a certain type of coding and categorisation is chosen that makes it possible to contrast the different statements and present the collected data in a comprehensible way. In the subsequent conceptualisation, the collected data can be abstracted and put into connection so that a coherent concept emerges. In this continuous process of comparing the similarities and differences of the statements, the categories can be related to each other and their relevance for explaining the research question and hypothesis can be checked.

The memos serve as a support in this process. Similar to a logbook for data collection, these memos contain thoughts, ideas and discovered patterns that the researcher notes down during or shortly after the interview and can use for further analysis.

However, these different steps do not have to follow any particular order, but take place circularly, sometimes simultaneously, and alternate constantly (Glaser & Strauss, 2010). Since this circularity is difficult to present in the context of a scientific paper (Heiser, 2018), the steps are presented linearly in this analysis.

ii. Sampling

The aim of qualitative sampling is to be able to identify the overall situation by determining the specific (Helfferich, 2011). However, it is important that all relevant actors are included in order to avoid a distortion of reality. Unlike random sampling, which is commonly used in quantitative sampling, selective sampling, as in this case, uses carefully chosen criteria. These relate both to attributes that the interviewees must fulfil and to the sampling size, which must be determined before the interviews are conducted. (Kelle & Kluge, 2010) The criteria of the interviewees were not limited by sociodemographic attributes such as age and education level in order not to restrict the sampling too much. However, in the final composition of the interviewees, it was ensured that the proportion of men and women remained relatively balanced.

In order to portray the heterogeneity of the research area (Kelle & Kluge, 2010), different stakeholders relevant to the research question were included. For the exact selection, the researcher chose specific criteria that are described in the following paragraphs.

All of them were required to have some expertise in water management, agriculture in Andalusia and sustainable development, but at least in one of these areas. The origin from Spain or at least the professional involvement on-site was desirable to integrate fact-based first-hand experiences instead of external opinions. Language also played a role, as due to the knowledge of the researcher, either English or German or Spanish with a translator had to be ensured for an adequate exchange.

Since all three areas are very broad and include a large number of actors, at least key stakeholders should be interviewed who are directly affected by the topic or have an influence on it and come from the most diverse areas in compliance with the heterogeneity mentioned above. Due to a lack of response despite several requests, the perspective of the regional government and the water authorities could not be included. Nevertheless, the integration of a variety of perspectives was achieved.

Scientists and researchers of different backgrounds were included, some of who have leading positions in regional water foundations or work in academia, and whose roles as educational entities are essential. In order to include not only the theory of science but also practical experience, a representative of an international water company specialised in desalination plants and water supply for arid and risk areas was included. Farmers were also interviewed, who were able to report on water scarcity and political decisions from their perspective as people who are directly affected by both variables. The perspective of NGOs as representatives of the environment that is directly affected by agricultural and water activities, as well as that of international organisations that aim to combat desertification and mitigate the impacts of drought in order to achieve sustainable development in the long term, were considered relevant.
It was also important to integrate a narrative from the EU Commission to get a general perspective on Spain and the EU as a whole and to understand political aspects. This was complemented by lawyers and consultants, either working for the EU Commission and the Parliament or working at national level, who advocate for sustainable development and water security as well as contribute significantly to the legislative decision-making process.

In addition, one interview was conducted with an expert in the field of sustainable development to provide at least one perspective that comes from outside Spain and focuses more on the big picture.

Altogether, this resulted in a sampling size of 11 interview partners, which was regarded as appropriate by the researcher after further approval of the supervisor. Further information on the interviewees is given in section 3.b.iv on the conducting of the interviews.

iii. Interview guideline development

As a research instrument, an interview format has been chosen that was mostly standardized in order to enable direct comparisons of the different narratives. During the interviews, all relevant questions were asked to allow a data comparison. However, some flexibility was reserved in order to be able to respond directly to the interviewee and to ask expert-specific questions. Thus, the order and wording of the questions can vary slightly. In addition, the scope of the questions was adapted to the time of the interviewee. Altogether, neither adding more questions nor shortening others led to an incomparability of the data. In particular, the expansion of the questions made it possible to add further data that made the overall impression of a narrative more precise.

Inspired by Schütze (1976), the aim was to facilitate impromptu narratives. These are characterised by a trusting and open atmosphere in which the interviewee can talk about his or her experiences, especially about personal experiences in a crisis situation. The following study also refers to a crisis, namely water scarcity as a crisis of existence for living beings, ecosystems and the economy. For the later analysis, narratives contain important details that contribute to a better understanding of the overall context, which makes their accurate recording relevant. The mechanism chosen to trigger this narrative, which Schütze (1976) describes as a narrative compulsion, is the condensation compulsion. This provides information about which aspects of the overall situation - in this case water scarcity and water management in Andalusian agriculture - the narrator considers important and which ones not. From this kind of condensation, the respective relevance can be concluded in the analysis.

In order to make these impromptu narratives possible, as little as possible was intervened in the narratives and attention was paid to certain coda indicating that the narrator had finished his or her narration. At the beginning of the interview, it was also pointed out that there were no correct or incorrect answers in order to support a free flow of speech. (Schütze, 1976)

It was intended to give the interviewees as much space as possible to present their personal experiences, which were only evoked and roughly limited by the respective question. How detailed or concise the answers were, was at the own discretion of the

participants. According to Strauss (1994), this is the profound basis for grounded theory.

The structure of the questionnaire was chosen freely, but its basic components follow a logical sequence. First, all questions were collected that came up during the research and were relevant to the thesis question regarding the barriers to sustainable water management in the agricultural sector in Andalusia. They were chosen in such a way that the answers either confirmed or negated the developed hypotheses. After this compilation, they were structured and partly reformulated in order to enable a reasonable flow. Finally, all questions were checked again for their relevance to the research question and the hypotheses and laid out in an interview script.

As the time of most interviewees was limited, it was only possible to ask follow-up questions in two interviews after their impromptu narrations of the main questions. Here, so-called “exmanent questions” (Heiser, 2018, p.177) were chosen, which means that they had already developed and defined before the interview. These were oriented towards the interview's guideline and did not refer directly to unfinished narrations. (Heiser, 2018)

iv. Conducting of the interviews

In order to achieve meaningful, representative results, the aim was to conduct at least ten expert interviews. In the first contact, emails with a short introduction of the research were sent to potential candidates who fulfilled the previously explained criteria. A total of 56 interview requests were sent out. There were eight declines on the grounds of lack of time or uncertainty about being able to make an adequate contribution to the specific topic of the thesis, and 37 requests remained unanswered, whereby half of them were followed up with a new request via email. It has to be noted, that neither the river basin authorities nor the local government replied to the interview requests, which is why their perspective is not included in the outcome.

With the eleven confirmations, the following composition resulted: one historian and researcher in sustainable development, one representative of an NGO, one water technology consultant for river basin authorities and agrarians, one representative of the UNCCD, one scientist of a water foundation, one lawyer and consultant for public

institutions in environmental matters, one representative of the EU Commission, one executive manager of international desalination projects, one consultant for sustainability and water security, a married couple of greenhouse farmers, and a director of a sustainability foundation. Aiming towards a balanced outcome of this research, seven of them are women, and five of them are men.

With one exception, all of the interviewees come from Spain or have a direct professional connection to Andalusia. The length of the interviews varied from 14min to 38min and averaged 22.6min.

Each interviewee has been assigned a number and, in order to guarantee their anonymity, are not described further or mentioned by name. For one interview, a translator has been consulted, who does not appear in the statistics above.

Since impromptu narrations are particularly important for grounded theory (Schütze, 1976), the exact question of the dissertation as well as the hypotheses were withheld from the interviewees so that they would only concentrate on the interview questions and not try to answer the question of the dissertation. All interviews were conducted orally, but not directly in person due to the constraints of the pandemic at that time. Therefore, ten of them were conducted via communication platforms, mostly with video, and one by telephone. This allowed for a free flow of speech and flexibility in the conversation.

Prior to the interviews, permission was obtained from each interviewee to record the conversation in audio format. The audio files were transcribed in a next step. For the sake of the completeness of the grounded theory, a complete transcription was chosen instead of a selective transcription (Hussy, Schreier, & Echterhoff, 2013). Only the parts that would reveal too much about the identity of the respective person were excluded.

The transcription was done manually without any computer programmes. The sentences were transcribed word by word with minor modifications to grammar and sentence structure. Expletive words and pauses were not recorded because they did not seem relevant at the time of the research. Likewise, non-verbal expressions were

excluded, except in one particular case where the interviewee's laughter was noted in order to emphasise for the record that the statement was meant in jest. In individual cases, words were written in italics to underline that they were emphasised particularly clearly or to indicate a technical term. Longer pauses and open sentences were indicated with '...'. In the analysis and evaluation of the interviews, however, the content of the statements stood in the foreground, as these were more decisive for the research question and the testing of the hypotheses than the language behaviour itself.

Words or passages that would reveal too much of the interviewee's identity were anonymised with 'XXX'.

Most of the interviews were conducted in English, two in German and one with the help of a translator in English and Spanish. Accordingly, the audio recordings were transcribed, whereby only the English version of the conversation with the translator was transcribed and not the direct answers in Spanish. Thus, it was ensured that the direct impromptu narrations were captured without losing any information through further translation.

v. Research ethics

The consent of each interviewee as well as their voluntary participation represented the base of this research. They were informed about the aim of the questionnaire, the data handling and the audio-recording, which they approved before being interviewed. The participation was not compensated. With a guarantee of no harm, the interviewees were free to refrain from answering any questions with which they feel uncomfortable. They were also given the right to withdraw from the research without further consequences.

For data protection, efforts were made to ensure that no references appear in oral or written reports that could link the interviewee to the data, nor were the individuals identified as a participant in the project. The audio files of the conversation were destroyed after the completion of this project and personal data within the transcript anonymized.

Furthermore, each participant was informed at the beginning of each interview that there are no correct or wrong answers to the questions and that their responses will be anonymous and will remain completely confidential.

vi. Coding processes

After the completion of the interviews and the creation of the transcripts, the three-stage coding process takes place. According to Strauss (1994), this includes open coding, axial coding and selective coding.

The first step in open coding is to develop concepts on the basis of the collected data and to abstract them in a way that they can later be synthesised into categories. To do this, each individual transcript is examined more thoroughly, whereby the contained statements are first broken down thematically in relatively small steps and provided with a code. These codes should reflect the content of these statements for further processes. In a next step, the resulting variety of codes is combined into more abstract and theoretical categories.

As the name of axial coding suggests, an axis helps to establish connections between the created categories. In this process, it is examined how the categories are related to each other. The result of this second coding is then a coding paradigm. (Heiser, 2018)

This is followed by selective coding, in which core categories are determined to explain the phenomenon under investigation. This sequence of coding makes it possible to create an analytical story that tries to explain as comprehensibly as possible how the phenomenon could develop. (Heiser, 2018)

For the open coding, the programme ‘MAXQDA’ was used to keep the manual creation of the codes clear and flexible, and the digital workspace used to illustrate the axial and selective coding was ‘Mural’. Apart from that, the creation of the tables and all other processes were implemented without specific programmes and were not supported by automatic software regarding their content.

Open coding

In the open coding, both specially formulated codes, which are also called sociological-constructed codes, and in-vivo codes as quotations of particularly concise statements were used (Strauss, 1994). A list of the final developed codes is shown in annex nº1. For this purpose, a number was assigned to each concept and both the source, or transcript number, and the corresponding paragraphs were listed, which were also noted on the side of the transcripts in the appendix. In qualitative research, this transparency is a particular quality criterion in order to make the individual steps comprehensible (Heiser, 2018).

During the creation of the codes, some content-related similarities already became apparent. In order to keep the data more manageable, redundancies were filtered out after the coding was completed, which means that codes with similarities were merged, and a more precise concept overview was created. Nevertheless, the intention was to preserve as much detailed information as possible. (Heiser, 2018)

On this basis, categories were then created, whereby one or more concepts were assigned to an appropriate category. The corresponding table is shown in annex nº2. Here again, attention was paid to traceability and transparency, which is why the concept numbers that make up the category were listed behind the individual category. For overview purposes, this table was numbered consecutively with Roman numerals in order to abstract it more clearly from the concept table. A total of 79 concepts and 16 categories were created. It should be mentioned that not all 79 concepts were used for the 16 categories, as the interview questionnaire did not only focus on the barriers to sustainable development in water management, but also asked for possible solutions and opportunities for the future and tested the second hypothesis about the importance of an improved discourse as a possible solution. Although all statements were given a code, the grounded theory created here refers to the test of the first hypothesis, specifically its sub-hypotheses, regarding the question of barriers.

The titles of both the codes and the categories depend on the coder and could be formulated differently in extended research or rework. The importance lies more in the later results for testing the hypotheses.

Axial coding

As previously mentioned, axial coding involves relating categories to each other. For visualisation, the coding paradigm is often used as a heuristic tool. For this, one category at a time is selected and placed in the centre of an axis. On the left side of the axis are the contextual conditions, which should represent the cause of the phenomenon or category under investigation. On the right side of the axis is the consequence and thus the effect of the phenomenon. Above the axis are the intervening context conditions, which have a reciprocal relationship to the phenomenon. They represent the structural framework conditions, which can be of a local, temporal, but also social nature. (Strauss & Corbin, 1996)

The intermediate link between the cause and the consequence are the so-called action strategies. These describe the actions of the actors, which represent the execution of the cause or the coping or dealing with the situation, and which ultimately results in the consequence.

This coding paradigm was created for each category and can be found in annex nº3. Before presenting the results in more detail, it should be mentioned that for axial coding, two elements have always remained the same regardless of the category. One is the intervening context conditions, and the other is the consequence, since both the context and the consequence of the phenomenon remain unchanged. The precise content of these two variables will be described in the further course of the analysis.

Selective coding

In the third coding phase, the phenomena or categories from the axial coding are once again juxtaposed and all action strategies are examined for similarities. These similarities are then used to develop core categories that can be found in all areas and attempt to explain the phenomenon. (Heiser, 2018) For the elaboration of the core categories chosen for this case, the freedom was taken to formulate them in very general and broad terms. As already mentioned, the purpose of this work is to test hypotheses. For further research with the aim to create a new theory, other core categories can also be defined here to allow a more precise elaboration of the type creation. In grounded theory, type creation usually follows selective coding in order to provide an improved basis for the final theory creation. (Krotz, 2005) However, since

the aim of this work is only to test hypotheses and not to create a new theory, this scope of the work focused exclusively on the three coding processes and no further type creation was carried out.

After going through the three coding stages, it is thus evident that they form the basis for a theoretical model that is anchored and justified in empirical data, and thus can be referred to as a grounded theory. (Heiser, 2018)

4. Empirical findings: descriptive presentation

In this section, a descriptive presentation of the results of the grounded theory will be given. For this, the results of the axial and selective coding will be presented. The codes referred to are shown in brackets and can be found in annex nº1in order to find the appropriate text passage in the transcripts. In some cases, direct quotations from the interviews are shown, which can be found directly in the transcripts in annex nº5.

For all coding paradigms, both the intervening context conditions and the consequence remained the same. The informal norms of society (code 10), as well as capitalism (code 11), represent the framework conditions for all categories defined here.

From the different narratives, it has emerged that the norms of society directly contribute to the extent to which sustainable development laws are implemented. "If people do things that they agree with morally and culturally if the laws are aligned with what you believe in, it is much easier to implement these laws". (Transcript 09, Pos. 5) For Spain in particular, it was mentioned that sustainable development was publicly addressed comparatively late out of "purely cultural" reasons (Transcript 09, Pos. 8), which is why compliance with new EU directives was more difficult, especially at the beginning.

As some areas of Spain are protected in order to preserve biodiversity, it was also perceived that they "haven't lost as much" (Transcript 09, Pos. 8) and therefore did not see the necessity to change entire systems. According to the narratives, this consciousness has changed towards a stronger awareness of the value of water and the

environment, and a recognition of the seriousness of the situation by a wide range of actors (code 1).

The often negative image of the term 'sustainability' among the population was also mentioned. Many people associate the decision for sustainability with "sacrifice" and the abandonment of "quality of life and profit". (Transcript 01, Pos. 3) Since fewer opportunities are seen in it, this area remains less interesting for "investments and new developments" (Transcript 01, Pos. 3).

Even more frequently, the issue of current capitalism (code11) emerged, although not all narrators explicitly described it as such. The economic system underlying the overall matter was described as oriented towards profit, growth, "economic activity" and output, while financial costs are kept as low as possible, especially by large companies (Transcript 01, Pos. 3; Transcript 04, Pos. 16; Transcript 09, Pos. 15).

This pressure causes the rather short-term perspective of some actors and makes them work against each other rather than listening and trying to understand other perspectives (Transcript 03, Pos. 25). It also gives "the wrong signals“ for „how we use the basic resources for our economy" (Transcript 09, Pos. 19).

Although this system does not have a promising future (Transcript 07, Pos. 9), it is difficult to achieve sustainable development under these conditions (Transcript 01, Pos. 3). In addition, it was mentioned that if the current structures and incentives are maintained, this limits the society's ability to contribute to a positive development, which means that the personal values of individuals can hardly make a difference (Transcript 01, Pos. 14).

The two codes 10 and 11 thus represent the mood and attitude of the general society and firmly established economic systems which set the framework conditions of the categories. The consequence of the phenomena presented here is that barriers to sustainable development in water management for agriculture are created or maintained, with the result of the persistence of the water crisis (code 1).

a. Lack of knowledge dissemination

Causal conditions

The first coding paradigm (see annex nº3.1) aims to design an analytical story around the concept of the first category to test the following sub-hypothesis: Lacking knowledge dissemination among stakeholders on sustainable development causes wrong decision making and mismanagement in agricultural water management.

The majority of the interviewees named imbalanced power structures as causal conditions. These are reflected on the one hand by the lobbying power of the irrigating sector at the regional, national and EU level and on the other hand by the restriction of the power of environmentalists. The latter are limited in their actions as the legal framework does not give a voice or certain rights to the environment that could be claimed. (code 12)

So far, there is also no space available to bring all stakeholders together to discuss water management problems in agriculture and to jointly develop concepts for potential solutions. (code 14)

In addition, there is a lack of awareness about sustainability and the consequences of overfertilization (code 13). Thus, the problem is rather seen within the people than within public authorities. In one expert interview, it also emerged that the narrator, despite his expertise as a researcher in this field, does not see any opportunities for himself to contribute to sustainable development, as this would be in the power of actors in the water management sector. (Transcript 11, Pos. 12)

Furthermore, there is a high demand for certain crops, such as olives, berries, citrus fruits, tomatoes and cucumbers, which are water-intensive to grow. Around this demand, a large market has built up from producers of plastics and chemicals for fertilizers to logistics. This also gave rise to the hope of farmers to increase their income by satisfying the growing demand. Especially for regions like Almería, which traditionally have a low level of income, this has been a strong incentive to expand local agriculture. (code 15)

Action strategies

This initial situation has led to a majority of farmers practising conventional agriculture and the persistent intensive use of groundwater resources (code 19), which in turn fuels water scarcity. Although farmers reported that climatic conditions also play a role in deciding for the chosen type of cultivation (Transcript 10, Pos. 7), the intensive production and expansion of agriculture can be attributed to the growing demand (code 15). While some narratives criticised the "short-term" perspective (Transcript 02, item 4) and inability to learn, despite being directly affected by water scarcity and drought (Transcript 03, item 3), others pointed out that farmers continue to act in this way due to the pressure of market demand and the capitalist system. On the one hand, they are forced to destroy parts of their crops to avoid a sharp drop in prices (Transcript 04, Pos. 12), and on the other hand, families who depend on agriculture are more interested in providing for their families as best as they can for the moment to survive rather than being able to think about the next generations (Transcript 07, Pos. 8).

As it turned out, the farmers' initial expectations to become rich remained largely unfulfilled. As they see an opportunity for a better financial future in the market demand coming especially from abroad, they increase their irrigated agriculture which became more technologized over the last decades, but simultaneously they increased their debt to finance this expansion (Transcript 04, Pos. 10-11). As the farmers are also not in the position to claim prices, among other things, due to a large number of farmers' associations, which are, however, so small that they do not present a strong lobby, they have to accept the low price determined by the supermarkets and wholesalers (Transcript 04, Pos. 16). As more crops are produced through the expansion of irrigated agriculture, yields are destroyed to prevent a drop in prices. (Transcript 04, Pos. 12). At the same time, they also have the pressure to increase their production in order to pay off their debts. (Transcript 04, Pos. 11). Thus, even larger agricultural enterprises remain unprofitable.

One expert reported that even after the drastic growth of greenhouses since the 1960s, these regions have remained the poorest areas in Spain. (Transcript 04, Pos. 10). The fact that “many costs are externalised onto the environment and people (…) who have no lobby (…) to claim the real prices” stands in the way of the development towards

sustainability. (Transcript 01, Pos. 3) Consequently, the farming sector remains a threat to sustainability and ecosystems (Transcript 06, Pos. 10).

Another action strategy is the low participation of some stakeholders in the exchange on agricultural water management. This includes some farmers who are in the vicious circle of productivity and who do not have a strong lobby and therefore do not contribute much to the discourse. In addition, there are other sectors and stakeholders who are not explicitly mentioned, but who do not regularly participate in the dialogue. Public participation is also relatively low. (code 16)

Most stakeholders continue to focus on their own interests (code 18) and due to the incapability of gathering all stakeholders together they „continue to talk in separated boxes“ (Transcript 03, Pos. 27). The issue of water scarcity, therefore, remains an insufficiently discussed topic that is largely inadequately addressed and misinterpreted, or as one narrator described it: “the concept of water scarcity (…) is a black box“. (Transcript 09, Pos. 17).

This confirms the first sub-hypothesis that a lack of knowledge dissemination among stakeholders on sustainable development causes wrong decision making and mismanagement in agricultural water management.

b. Non-inclusive policy and legal framework

The second sub-hypothesis claims that the non-inclusive policy and legal framework favour an unsustainable, growth-oriented food system. In order to test it, three different coding paradigms were created. The first relates specifically to the complexity of water management in Andalusia (annex nº3.2), the second focuses on the context of the government (annex nº3.3) and the third complements this paradigm with a view to the EU level (annex nº3.4).

i. Complexity of water management

Causal conditions

A central point of the causal conditions is the conflict of competencies. First of all, the semi-federal system of Spain plays a role, which is why there is a basic national

legislation for all Comunidades Autónomas, but there are further different legislations at the regional and local level. It is often the case that the regions are less committed to meeting the objectives of the Water Framework Directive compared to the central government. Although a majority of the available water in Andalusia is controlled by the Confederación Hidrográfica del Guadalquivir, in some cases the basins lie within the competence of the regional authority, the Junta de Andalucía. Additionally, further water sources exist that are shared with other regional authorities. On top of that, there are the interests of the various ministries, from agriculture to environment. In this complex system, it is difficult to coordinate all interests, as the different administrations pursue different goals and tend to work against each other instead to cooperate. (code 20)

One example of this that has been mentioned was that the agricultural ministry is rather willing to pay a fee instead of implementing changes to adapt to water regulations, in order to support farmers in the short-term but without considering environmental matters. From this one can derive that the fees are comparatively low which again limits the incentive to comply with the law. (Transcript 04, Pos. 19)

Also, the hydropower sector has been described as only focusing on producing energy without considering environmental aspects, which means that this sector does not further engage to help to find solutions for securing water in the region. (Transcript 03, Pos. 32) Nevertheless, it has to be mentioned that the hydropower sector is not included in the narratives, which is why this presentation merely reflects the perception of other actors.

The general problem is that "there are too many administrations at the same time" (Transcript 04, Pos. 19). Related to this issue is the non-alignment of agricultural policy and water policy, as they pursue different and sometimes opposing goals and hence act in different ways. (code 20)

Next to this, there is a lack of control and planning. This concerns irrigated agriculture, which has continued to expand relatively uncontrolled while some farmers have also switched to irrigation. As some water rights have been already allocated in the past, it

is difficult to take these away from them. Therefore, there were not necessarily more water rights awarded, but the total volume of allocated water has increased. (code 21) Andalusia is not only an agricultural region but also a tourist destination. Thus, the uncontrolled construction boom for tourism plays a major role, as this has also increased the demand for water. This development also meant an expansion of urban areas, as many constructions took place in regions that have not been habituated before, from which one can derive that they lack in a certain infrastructure, or this infrastructure had to be built there. Some of these buildings remained unfinished or abandoned, as the people were not able to pay for the house and the water. (Transcript 06, Pos. 7)

In addition, there is no holistic legal framework that sufficiently includes environmental protection. Thus, there is still room for overexploitation of water resources. (code 22)

Action strategies

The resulting activities are, for example, the water cut for the agricultural sector. One narrator describes it as "two realities at the same time" (Transcript 03, Pos. 2) because on the one hand farmers are supposed to save water due to the scarcity, but on the other hand, the water supply is still guaranteed for the increasing tourism and urban areas (code 23).

It is a particular challenge for the local people to meet the growing demand for water in all sectors with the necessary infrastructure. At the same time, however, compliance with the Water Framework Directive must be ensured, which states that a good condition of water bodies has to be ensured. It is challenging to meet both objectives simultaneously. At the time when the water system that still exists today was established, it was highly effective because it enabled the equal distribution of water among the basin users. It was also considered advanced in terms of infrastructure and management. Since the Water Framework Directive was enacted, environmental objectives have been introduced, which have to be met as well. (code 27) It was explicitly stated that the Spanish authorities have difficulties in fulfilling these opposing goals (Transcript 03, Pos. 13).

The basins of Andalusia are highly regulated through reservoirs, dams and other infrastructural means, which makes it a very unique case in the world. But it is not managed in a sustainable way, as environmental protection remains inferior, and the management is rather reactive than preventive. (code 24) If the river basin management plans continue to satisfy the demand without adequately considering the shrinking resource, the situation will be "more dramatic (...) in the short- and medium-term" (Transcript 07, Pos. 3).

Due to the lack of incentives, authorities largely avoid joint coordination (code 25) and continue granting existing water rights independently from the increasing volume of water abstraction (code 26), which is why their actions are considered ineffective by other stakeholders (code 25).

ii. Government

Causal conditions

The most frequently mentioned barrier in this study has been around the government. However, it needs to be mentioned again, that the perspective of the government is not included here, hence why a certain bias might have been created.

As explained in the previous paradigm, there is a lack of control and planning from the government, particularly with regard to the expansion of irrigated agriculture and tourism, which both have contributed to an increased demand for water. (code 23)

A frequently mentioned point, however, was the mindset in leading positions, which is seen by some stakeholders as an obstacle to sustainable development. Political decisions often follow the objective of gaining political support. As a vote in rural areas counts more than a vote in urban areas, the agrarians represent an important voter base. Therefore, politicians pay more attention to satisfying the needs of these voters compared to other concerns. (code 28) To achieve sustainable development, it was claimed that politicians should engage and make decisions independently from elections (Transcript 01, Pos. 7) although this aspect might not be feasible in reality.

A very common strategy of the government is the avoidance of conflicts by “throwing the ball to everyone else first”, let the stakeholders fight about the issue and then try

to satisfy each of them a little bit. Especially one narrative expressed that in these situations, he feels used by the government, which is only pursuing its own interests. "I hate when they do that, and we end up like goofs directed to that. It is absurd and it is difficult." (Transcript 03, Pos. 32)

Furthermore, the commitment of the government is highly dependent on its own perception, hence why its openness for cooperation and exchange depends on “the way they feel like this topic is important or not” (Transcript 03, Pos. 31). In the long run, it is problematic if politicians continue to act as if there will be enough water in the future. Their actions so far do not show that they are aware of the danger of water scarcity and that water management plays a considerable role in food security. (code 28) Hence, it can be concluded that the awareness of the WEF nexus is not fully given in the minds of political decision-makers.

Even when modern measures are chosen to help improve the situation, there is often a lack of human and financial resources to implement these ideas. (code 29).

Another condition is the cost of water, which is also determined by the government. Generally, groundwater is so inexpensive in Spain that there is no incentive for farmers to reduce the volume of water they use and make their irrigation more efficient. The price the irrigator pay does not reflect the actual value of water, as the environmental costs are not included. (code 31) It was mentioned that the 'polluter pays principle' has not been introduced to the irrigators and other major stakeholders of water use. (Transcript 05, Pos. 7)

At the same time, alternative water sources, such as desalinated water, are very expensive. Although some farmers' associations are campaigning for low taxes on tap water, these costs also remain high. „It is cheaper to irrigate with champagne“. (Transcript 10, Pos. 18) This limits the statement of some narratives that the costs for water in agriculture are too low, as these do not include alternative water sources, whose price remains high and thus is not an attractive alternative for irrigators.

These factors give rise to the hitherto unfulfilled need to educate politicians and the public about sustainable approaches that concern water use and furthermore the need to raise the price of ground water.

In addition, the process of applying for a legal well installation at the Office is cumbersome and often takes years. As the impact of this system has not improved, (Transcript 10, Pos. 9) it can be concluded that the government has not effectively addressed these processes over the past decades.

Action strategies

To continue directly with the action strategies at this point, these long approval processes have the consequence that many wells are first drilled illegally before they receive an official permit after years. This behaviour is particularly typical for the newly developed agricultural areas and greenhouses. It „ is more a consequence than a cause“. (Transcript 11, Pos. 9) This, in turn, relativises the effectiveness of water management, as although authorised water abstractions are measured and registered, the water drawn from illegal wells can only be estimated, which is why inaccuracies occur in the overall management. In the intensified closure of illegal wells, a fine was imposed on the respective users. (code 40) Although the legality of groundwater use is a widespread problem, especially in the south of Spain, even after the mass closure of illegal wells, no alternative solution was offered by the government to legally obtain water for basic needs. (Transcript 10, Pos. 11).

Due to causal conditions and societal beliefs, unambitious laws and regulations are created (code 33) and already existing ones are not strictly enforced (code 34). More ambition in legislation is highly required, as well as a reform of current water law to prevent pollution and overexploitation of water bodies. The current law approves intensive use of pesticides (code 41). Although more and more farmers are calling themselves 'green' because they comply with the necessary laws, their approaches are not necessarily sustainable. Even with a green label, they are still allowed to over-exploit water resources, use plastic, generate high greenhouse gas emissions or contribute to soil erosion. In addition, technologized, modern agriculture is linked to bad labour conditions and illegal field labour, which is also practised in Andalusia. (code 43)

This is connected to the next point of a lack of transparency in food production. The law does not require exact traceability of food, which indicate the conditions under which the product was produced and the environmental and human impacts of its production. (code 42) However, it is a legitimate right of consumers to have access to this information. „We should know who is doing good and who is doing things badly." (Transcript 04, Pos. 25)

A legal loophole also affects the consumption of the population. Every year, more than 30% of food is wasted, which keeps market demand artificially high and continues to put pressure on farmers' production. This high rate of food waste shows that, especially in Europe, a large part of the population does not need as much food as is produced. (Transcript 04, Pos. 30)

Due to the lack of control and planning and a missing holistic legal framework, both tourism and irrigated agriculture are being further expanded. However, the latter is increasingly gaining opponents who do not support this development. It is criticised that even irrigators with a permit for water access or wells still use more water than they need in some areas, which was also confirmed by farmers from a dry region. (code 39) Those who have constant access to water pay less attention to their efficiency, which leads to less water being available for other users. (Transcript 10, Pos. 20)

Another problematic area of action strategies concerns governmental spending (code 36). Some government-funded projects, such as the construction of dams, reflect the government's short-term perspective. It sees in these projects the benefit of securing jobs in the regions for the next few years to enable the implementation. However, environmentalists criticise that these funds can also be used to finance environmental measures that are more cost-effective in the long term and also improve and protect ecosystems. (Transcript 03, Pos. 23) Given the high food waste, declining water supply and intensified climate conditions, this might imply the need for agricultural workers to be retrained for other not water-intensive work. Considering the statements in Transcripts 09, Pos. 5, and 10, Pos. 7, 14-15, this does not seem entirely realistic, as the expectation that alternative water sources through technologies such as desalination plants are the solution of the future is very high and elements such as culture, the norms of society, tradition and heritage also play a role.

In some cases, public funding is also allocated in the wrong place as the consequences have not been properly assessed first. An example of this are the publicly-funded technologies for improved efficiency of water use, which were hoped to save water, but led to the expansion of agriculture, as the irrigators had more water available due to the savings. Thus, the decrease of the water level of aquifers continued. (Transcript 02, Pos. 12)

Public infrastructures and their expansion and maintenance are usually paid by public funds and not by the economic sector. From the statement in Transcript 05, Pos. 7, it can be concluded that in this sense a free-rider problem exists, as the economy enjoys the benefits of this infrastructure and uses it on a daily basis without paying for it. The narrator specifically refers to large local companies, from which it could be expected that they have the necessary financial assets to pay for it. This complements the low cost of the groundwater mentioned earlier. (code 31)

This way of distributing costs and subsidies favours non-organic farming and perpetuates the faulty image that the current system is highly profitable, and that sustainability is generally expensive. "As long as this doesn't change, only radical believers can have organic farms, who are willing to take great personal risks, and who actually work against the market. Or against what the market seems to demand." (Transcript 01, Pos. 17)

However, the misallocation of investments is not exclusively a case within the government but also occurs in international organisations and institutions. This is a particular obstacle to the implementation of innovative projects that represent potential solutions to water scarcity. There is still a need for improvement in this area of financing. (Transcript 08, Pos. 21)

Moreover, the investment management of the government was described as inflexible. Since a fixed amount is determined for certain areas within the annual budget plan, partly necessary measures might not be taken because the fund for them is already empty. At the same time, however, investments can be made in less necessary areas if these budgets are still filled. This is also due to the overall structure that the population is not first asked about their vision for the future before projects are planned and funds

allocated. As a result, public investments are made that do not necessarily correspond to the needs and ideas of the population. Altogether, this is described as a rigid system, which restricts the room for a scope of action and flexibility. (code 37)

Generally, there is a lack of commitment to sustainable development on the governmental level, especially of the individual regions, which is also coupled with the strong lobby of the agricultural sector. Thus, the EU is comparatively more committed, although the commitment of the elected politicians of the member states would have a higher legitimacy. (code 35) The previous setting of limits and restrictions of unsustainable behaviour is strongly "below the potential of politics". (Transcript 01, Pos. 7).

Currently, at least the openness for exchange of the government is perceived as positive by some stakeholders. Nevertheless, there has been a reluctance to change for a long time, as governmental engagement depends on investment capacity, which in turn is influenced by self-interests and market demand. (Transcript 03, Pos. 31)

iii. European Union

Causal conditions

The causal conditions for the EU show some overlaps with the government of Spain and Andalusia. Once again, the lack of enforcement of laws should be explicitly mentioned. Similar to the national level, there are less clearly formulated and ambitious laws for sustainability that apply to the agricultural sector. (Transcript 06, Pos. 10) A core element is the strong lobby of irrigators and agriculture ministers. At the national level, “they benefited from the current status quo of the water management“ (Transcript 05, Pos. 6), but represent a major obstacle for sustainability, as they overrule all riverside improvements that have been planned to be implemented for securing the environment.

It has been stated that the irrigators have a strong lobby linked to the economy but an even stronger influence on the shaping of public opinion. For example, large demonstrations are organised with irrigators from all over the country in front of the central government building in Spain. Among other things, they appeal against the water cuts in agriculture, although these cuts are necessary in order to comply with the

water acts and laws. (Transcript 05, Pos. 7) However, „they have a lot of power and a loud voice and they claim their allocated volumes no matter what“ (Interview Transcript 07, Pos. 5). Their year-long pressure on public authorities enabled them to receive commitments to increase water allocation and the volume of legal water use (Transcript 11, Pos. 6)

This voice permeates through to the EU level. The agriculture ministers play a significant role here, as they are supported by a large number of people and are accordingly strengthened with financial means. It was mentioned that the Directorate-General for Agriculture and Rural Development only prioritises agriculture without considering the consequences for water and nature. However, a bias must be recognised here, as although a representative of the EU Commission was interviewed and another person who works closely with the Commission and the Parliament, there was no interview with this specific Directorate-General.

Action strategies

These contextual conditions have the consequence that the EU's initially more ambitious goals cannot be implemented, as the lobby of irrigators and agriculture ministers vote against them and these proposals are thus declined by the council. Many regulations for the protection of water and ecosystems, with which there are intersections with the agricultural sector, thus remain ineffective. (code 45)

In this context, the role of the CAP is evaluated differently by the narratives. Critics pointed out the short-term perspective of the policy and the prevailing focus on meeting the demand of irrigators. In their eyes, it would have been more beneficial to put the resources spent on the CAP into a sustainable transformation of the food production system in order to be better equipped for the future. (Transcript 03, Pos. 26) Others see an opportunity in its development towards „something much more tangible on environmental issues“ (Transcript 02, Pos. 7).

Similar to the national level, unsustainable investments can also be found in the EU action strategies, as economic goals continue to be pursued, which only take environmental matters to a limited extent into account. Nonetheless, some

stakeholders hope for a shift in these structures as a result of the Green New Deal. (code 46)

Considering all three paradigms in the context of the water management's complexity, the government and the EU, it can be concluded that the second sub-hypothesis holds true. The evidence confirms that the existing policy and legal framework is flawed in several dimensions and that the unbalanced inclusion of stakeholders has created a food system that is not considered sustainable with its strong focus on profit and growth. However, the hypothesis could be complemented by the fact that the policy and legal framework is not only non-inclusive, because the population is not included in certain decisions, nor is the 'voice' of the environment, but that there are also imbalanced power structures due to the strong lobby of irrigators and agriculture ministers that prevent any improvement towards sustainability.

c. Insufficient implementation mechanisms

Causal conditions

The third sub-hypothesis to be tested claims that insufficient implementation mechanisms of laws on water protection make their existence irrelevant. To avoid repetition, this paradigm was limited to define both the non-inclusive policy and legal framework and the lack of knowledge dissemination as causal conditions, which were already explained in the previous paradigms. Some of the key points were, that the environmental laws act against the alleged market demand, which makes their enforcement difficult (Transcript 01, Pos. 17). Furthermore, neither at the national nor the EU level are the legal frameworks developed to such an extent that the environment is given an adequate legal base to which representatives such as NGOs can refer (Transcript 03, Pos. 18). It was also shown that some authorities are rather willing to pay a fee than to make an effort to comply with environmental directives (Transcript 04, Pos. 19). Existing laws are not strictly enforced (code 34) and also the lack of human and economic resources prevents the implementation of "the legislation on the ground" (Transcript 07, Pos. 6).

Action strategies

An untouched topic in this work so far are alternative water resources that are provided by modern technologies. During the open coding of the transcripts, it has already been noticed that the sustainability aspect of these projects and their potential to solve the

problem of water scarcity is perceived very differently by the stakeholders. Despite their debated effectiveness, the implementation of these technologies was thus classified under action strategies. As it will become clear in the next paragraphs, there seem to be no legally established guidelines and knowledge exchange that could provide more clarity in this area.

One problem relates to the fact that theoretical solutions do not necessarily achieve the desired result in reality. In particular, the publicly funded conversion to more efficient irrigation was often mentioned, which led to the further expansion of irrigated agriculture. (Transcript 02, Pos. 11) As no regulations limit the irrigation surface, the farmers used the 'saved' water to expand and install more greenhouses and the situation remained the same that aquifers and water bodies could not recover. One narrator referred in this regard to the 'Jevons paradox' which states "that if you increase efficiency, the use of this resource increases" as well. (Transcript 04, Pos. 15)

Thus, further technologies that are primarily designed for efficient irrigation are critically viewed by some narrators, as more available water would rather lead to an increase in irrigated land. For some, this is not a promising way forward. (code 47) Although these technologies for water irrigation allow high productivity and the production of high-value crops in greenhouses, which is again connected to higher profitability for the farmers, they have on the one hand a negative impact on the water system and on the other hand also on the people, because despite the high development of the technologies the labour conditions are in some cases extremely poor (Transcript 11, Pos. 4).

When reflecting at this point the findings of previous research in chapter 2.b.ii, potential alternatives could range from improved integration programs for refugees and improved laws for working and living conditions for seasonal workers as well as additional measures for women’s rights and security. More research is needed, especially in the social dimension, to determine how realistic such efforts are in terms of their implementation and the financial resources they require, and how food prices can allow agricultural workers to be paid fairly without falling at the expense of low-income households.

Another failed attempt, which also only worked in theory, was the elimination of grass, as some farmers assumed that the grass only consumed the water for their olive groves. Not considering that grass is an important component of soil structure, this approach led to soil erosion, which was particularly severe in these areas because olives are often cultivated on a slope that favours erosion. Even the increased use of pesticides did not help, although they replaced the nutrients lost through erosion in the short term but did not solve the problem of erosion itself. (Transcript 04, Pos. 24) From this example, it can again be concluded that in finding solutions to the problem of water scarcity, an exchange of knowledge with experts from different fields is necessary in order to find long-term holistic solutions.

In addition to the problem of the farmers' high level of indebtedness in order to afford the corresponding technologies, as already described in chapter 4.a, the advanced technology leads to the perception of infinite water access. Some people heavily rely on the premise that innovations like desalination plants will solve their problem of shrinking groundwater resources. This again limits their incentive to change their current activities as technology is seen as a tool that enables infinite water access in the future. (Transcript 04, Pos. 20)

The farmers' statements confirm this assumption. Although they come from the driest region of Andalusia, they see it as unrealistic that they could run out of water, as they are located directly by the sea and can obtain desalinated water, which is expensive but available in abundance. They also state that the new technologies enable them to save as much water as possible and to use it efficiently so that they "only give the plant just the right amount" of water. (Transcript 10, Pos. 15)

Another interviewee commented that seawater is already available in large quantities and that desalination plants make it possible to use this water. One advantage is that modern technologies can transport water to areas where otherwise there is no water network available and even enable them to cultivate these areas agriculturally with products that are demanded at the market. (Transcript 10, Pos. 15) This contrasts with the statement of another narrative that while water use efficiency has been improved and all available water sources are being used, "there is nothing else that can be done

in terms of increasing water availability" (Transcript 11, Pos. 22) as this is done through the treatment of seawater.

The narrator, who positively speaks in favour of the technologies, sees the problem more with the countries that continue to act as if they are not affected by water scarcity, which will cause them major difficulties in the long term. (Transcript 08, Pos. 24) However, he also admits that with the current desalination plants, pollution must still be accepted. On the one hand, the residual water is flushed back into the sea, leaving behind residues that attack the ecosystem and can lead to increased algae formation or plagues of jellyfish. So far, there is a gap in research on how this problem can be adequately solved. In addition, the desalination plants are usually located in shallow water on the coastal strips, where the saltwater concentrate becomes denser and thus has an even more toxic effect on the environment. The infinity of available water must be put into relation to the effects of the currently available technology on the environment. (Transcript 08, Pos. 3, 5, 6)

In addition, there is the high energy consumption of the desalination plants, which are mostly fuel-driven. One possibility would be to connect renewable energy providers to the plants in order to reduce greenhouse gas emissions. (Transcript 08, Pos. 7)

But the impact on the tourism sector is not insignificant. On the one hand, there is a risk that the regions adjacent to the desalination plants will lose their attractiveness if plagues of jellyfish are caused by pollution from the wastewater in coastal areas. (Transcript 08, Pos. 4) On the other hand, in the case of a variant powered by renewable energy, it should be noted that the constructions required for this take up a lot of space and destroy the appearance of the landscape. For a region like Andalusia, for which tourism also has an economic significance, these are all elements that must be taken into account when deciding on such projects. (Transcript 08, Pos. 8)

For crisis situations, the technologies are nevertheless worth considering, especially for areas affected by environmental disasters such as strong storms or floods. Most of the participants expect that climate change and water scarcity will become worse in future. (code 6) Spain is also increasingly affected by serious environmental events: "We are going to have fewer and fewer resources available and more uncertainties of

the streams, more droughts but also more floods, and all more frequent and intense. (Transcript 03, Pos. 17). However, this floodwater is highly contaminated and harmful to health, which is why people have to rely on other water sources. An additional reason in favour of desalination plants in such cases is that these events massively destroy the local infrastructure which prevents the availability of former water supply. (Transcript 08, Pos. 20) This also highlights the importance of the WEF nexus, which was addressed in chapter 2.b.iii.

In addition to the debate about desalination plants and efficiency, there is often the problem that sustainable projects only take place on a small scale (code 48). One narrator describes it as 'frustrating' that the problems are usually very big, and the solutions are far too small and sometimes only implemented by an individual or small company. (Transcript 01, Pos. 22)

The hope rather lies in larger projects with a general validity, but for which the steering of politics is required (Transcript 01, Pos. 25-26). As this support is often lacking (Transcript 08, Pos. 21), these projects usually remain small and are only implemented by "radical (wo)men of conviction" who are "willing to take great personal risks" (Transcript 01, Pos. 17).

The third sub-hypothesis is an extreme statement, which cannot be validated based on the collected data. The existing laws on water protection are seen as essential by many narratives, as they guarantee the water supply for a variety of users and lately included more ecological aspects. It is correct, however, that the implementation of these laws is flawed and also the legislation for water protection leaves room for improvement. There, it might be more correct to state that the insufficient implementation mechanisms of laws on water protection limit the effectiveness of these laws and that the currently used alternatives of water sources do not fulfil the requirements for sustainability, as their environmental pollution and high energy consumption displace the problem rather than resolving it.

5. Potential solutions and future outlook

The aim of this chapter is to test the second hypothesis, which states that solutions to mitigate barriers to a sustainable water system lie in the inclusive discourse and exchange of knowledge about sustainable development which increases the stakeholders' awareness about their individual scope of action and their willingness to change. For this purpose, the majority principle was used to analyse how often a statement has been made in order to create an average opinion of the interviewees. In addition, a future outlook is provided, which is intended to show which stakeholders have an opportunity to achieve sustainable development of water management for agriculture from the different stakeholder perspectives.

With a clear majority of interviewees, it was found that constant exchange of the relevant stakeholders is necessary for sustainable development (code 77). The most common reason given was that this exchange is essential to understand the different perspectives and thus achieve "a more empathic view of the issue". (Transcript 03, Pos. 25) This was underlined by the statement that change always evolves when the logic of the individual actors is considered and addressed. Understanding each actor’s logic is also important in order to be able to set effective incentives accordingly. From this, it can be concluded that the stakeholders' driver to act must first be understood before incentive structures can be created that can support sustainable behaviour. (Transcript 01, Pos. 12, 15)

Other points that were raised in this context were that this form of enhanced cooperation would achieve co-responsibility in water management (Transcript 03, Pos. 16, 25). If all actors work together towards a shared goal (Transcript 11, Pos. 15), trust is built up through the constant dialogue (Transcript 11, Pos. 15, 18) and solutions can be found and better decisions made (Transcript 02, Pos. 18; Transcript 03, Pos. 27). The solutions would not necessarily be the best, but the most viable ones. (Transcript 09, Pos. 14; Transcript 11, Pos. 18). Besides a high learning outcome and more "structured and solid" plans (Transcript 02, Pos. 22), the improved relationships can open "a lot of doors" (Transcript 03, Pos. 32).

A certain degree of exchange does already exist to some extent (code 76), but a proper space where all stakeholders can come together and exchange is missing (code 14). Another critical aspect of this idea is that the capitalist system still exists, which tends to promote short-term perspectives and actions (code 11). Furthermore, there is a risk of getting stuck if many actors want to have their say and make decisions, and in the end, not much is implemented. (Transcript 02, Pos. 24; Transcript 08, Pos. 26)

For an improved solution, a room for exchange would have to be established, in which conversations take place at eye level (Transcript 11, Pos. 14) and all stakeholders participate (Transcript 03, Pos. 16). In particular, the farmers' perspective is considered relevant, as they are the largest consumer of water, are directly affected by scarcity (Transcript 02, Pos. 21) and can contribute to improved knowledge of what happens on the ground (Transcript 04, Pos. 23).

Furthermore, it is important to involve the population and create opinion synopses before allocating funds and implementing new projects as coping measures (Transcript 11, Pos. 19). As water scarcity is a global issue (code 5), a cross-national exchange can also help in solution finding processes, for example by sharing best practice examples (Transcript 02, Pos. 23). As a basic precondition for effective exchange, legislation must be in place that promotes sustainable agriculture (Transcript 05, Pos. 11; Transcript 06, Pos. 12).

Regarding the question of opportunities for solutions to overcome water scarcity, in addition to a more intensive exchange between stakeholders, different priorities were mentioned, which cover the three core categories of social, economic and political constraints from the selective coding (see annex nº4).

In the short or long term, all actors have an influence on achieving sustainable transformation, but with very different tasks (Transcript 01, Pos. 6). Most of the narratives saw the opportunities in the government, as it is primarily able to restructure the current investment and subsidy scheme. This includes, for example, higher taxes for unsustainable production and incentive creation for sustainable production. (code 49) Especially financial aids from the EU, such as the allocated funds for post-COVID recovery, which have been allocated at the time of this research project, would be a

"huge opportunity (...) for (...) projects that are not very costly and can bring many benefits, but also for awareness-raising and for education and for information exchange". (Transcript 07, Pos. 12) Together with international organisations and other institutions, improved funding opportunities for sustainable projects and pioneers can also be created (code 74).

Adequate pricing of water must also be established to reduce excessive water use, particularly ground water use, which is challenging but different ideas were proposed by the narrators, ranging from re-defining the value of water through its services for the environment (Transcript 09, Pos. 19), region-dependent price-increase via tariff or electricity costs (Transcript 11, Pos. 23), or public-private partnerships which would prevent water from becoming "a highly speculative commodity" (Transcript 08, Pos. 31).

The highest priority is also given to the reduction of water demand, which the government could achieve by limiting the irrigation area (Transcript 04, Pos. 14, 30; Transcript 05, Pos. 11, 13) and closing all illegal wells (Transcript 05, Pos. 13), although the latter is not seen as realistic, as this could trigger other conflicts (Transcript 04, Pos. 29).

Furthermore, a higher political commitment is required (code 51) through appropriate legislation (code 52) and making agricultural policy greener (Transcript 09, Pos. 11). However, the role of the government as an educator (Transcript 07, Pos. 11) and enabler of cooperation between administrations (code 53) was also mentioned, by setting appropriate incentives to engage in this dialogue (Transcript 03, Pos. 10).

For the private sector, providing advanced technologies and knowledge (code 55) has been emphasised. In this regard, flexibly applicable models (Transcript 08, Pos. 13) and holistic solutions are required (Transcript 03, Pos. 17; Transcript 08, Pos. 11-12), which are energy-saving (Transcript 08, Pos. 10) and sustainable (Transcript 02, item 15). In addition, companies can provide advocacy through their expertise (code 56) and become pioneers in the field of sustainability (Transcript 01, Pos. 6) through a mind shift of their decision-makers (code 57).

By reducing the number of current farmers cooperations and building fewer, bigger ones instead it would give the farmers more power to claim certain prices so that they can collectively determine the amount of production, the scope of the area and then the price for one good. (code 58) Another opportunity for farmers seen by some narrators is to focus on the quality of their crops rather than quantity (code 59). However, this aspect is controversial, as the decision for a certain crop also depends on the local water quality and other conditions, which means that a certain quality of crops cannot be achieved in some areas. (Transcript 10, Pos. 7)

Moving to the EU level, several tools for sustainable development have been mentioned, such as the Green New Deal, the Biodiversity Observatory and the CAP (code 61). To make the latter effective in supporting sustainable agriculture by considering environmental matters, it would be important to achieve a mind shift of the agriculture ministers, which is considered relatively unlikely at this stage due to the strong lobby of irrigators (code 62). This can be complemented by policy consultants who can include environmental considerations in their proposals (code 63)

In addition, NGOs, foundations and scientists can provide knowledge, raise awareness (code 64, 65, 70), reinforce their research (code 69) and increase cooperation between the different stakeholders (code 65).

Last but not least, society also plays an important role, as it can put pressure on decision-makers, demand changes in policy, make conscious purchases and change mindsets. Through this, it sets the mood for a transformation towards sustainability. Together with the economy, it can create optimal conditions under which politicians can act. (code 67) In specific cases, "powerful, independent individuals" were also mentioned, who have the financial means to facilitate innovative projects in all areas of water and thus help the entire population (Transcript 08, Pos. 26), as well as discourse experts in the media and politics, who can enable more transparency by exposing current economic and incentive structures as well as power systems, and thus stimulate a transformation-positive mindset shift in society (Transcript 01, Pos. 18-19). Regardless of status and financial means, each individual can exert influence in his or her environment and thereby contribute to a mood in the society that aims towards a sustainable development (code 67).

Altogether, an "interplay" of these actors must take place, in which their different functions are used in different phases of the development (Transcript 01, Pos. 6). Although the research focuses specifically on the case of Spain and Andalusia, the proposed solutions can be transferred to other countries and regions around the world that are specifically affected by the water crisis or can be used as preventive measures to mitigate future risk. Depending on the location, there may be additional details that need to be taken into account, or some criteria may be given a different weighting. Nevertheless, the solutions mentioned in this analysis are generally valid for addressing the global problem of water scarcity. In order to leverage the potential of these solutions worldwide, it is important that all stakeholders mentioned in this chapter exhaust their scope of action and actively commit to solving the issue.

6. Conclusion

The findings of this study indicate that barriers to sustainable development in agricultural water management exist at various levels. Regarding the consciousness of stakeholders, it was found that knowledge dissemination between them is limited, and that expert knowledge remains isolated in their respective sphere. In addition, there is a lack of space for joint exchange and incentives to participate. As a result, flawed decisions are made, some of which only work in theory or are designed for the short term instead for sustainable long-term goals. Ultimately, water as a resource is mismanaged. Irrigators and agriculture ministers also play a significant role here, and their strong lobby created imbalanced power structures.

In particular, the dynamics of capitalism exacerbate these structures, driving short-term profit, encouraging unsustainable consumption and externalising costs. This forces the actors concerned to take high personal risks in order to take a different path to preserve natural resources. The informal norms of society also provide unfavourable conditions to achieve a change towards resource security.

The existing policy and legal framework of Spain's semi-federal system are characterised by a conflict of competencies in water management and the existence of various entities that pursue different goals and thus do not cooperate well. A lack of control and planning leads to further expansion of irrigated agriculture, but also in

competing sectors such as tourism. This, in addition to a legal system that does not sufficiently protect the environment and natural resources and does not involve the population in relevant decisions on cost-intense projects, is favoured by an unsustainable, growth-oriented food system.

Some stakeholders criticised the government's lack of commitment, the focus on its own political interests, the corresponding allocation of financial resources and the high dependency of its commitment on investment capacity. Groundwater costs for agriculture are low and bureaucratic processes for legal water access are lengthy, which in turn stimulates the illegal construction of wells. Other alternative water sources remain too expensive, as it is difficult for sustainable projects to obtain government support. In addition, there is an uneven distribution of water cuts, which so far only affects agriculture but not the uncontrolled expansion of tourism. It needs to be underlined, however, that the government's perspective is not included, which creates a certain bias in this work.

At the EU level, the irrigators' lobby is preventing the determination of radical targets for more environmental-friendly agriculture in the member states. Hence, the effectiveness of some tools, such as the CAP, is questioned by some stakeholders. The emerging imbalanced power structures complement the hypothesis of the non-inclusive legal framework.

Contrary to the hypothesis, it was reported that the existing laws on water protection are an essential foundation, but that they do not yet prescribe any radical measures and that their implementation so far has been slow. In addition, many alternative water sources that have been implemented are not sustainable, and the projects that could actually offer sustainable solutions often remain too small-scale and funding opportunities for them are lacking.

Altogether, barriers exist in society, in the economy and in politics. In order to realistically achieve a sustainable water system, solutions have to address all three of these pillars. The majority of the interviewed experts agreed that an inclusive discourse and knowledge exchange is an essential solution approach. This must take place in a framework in which the stakeholders communicate at eye-level, balanced power

structures exist, and which is backed by a holistic legal framework. Besides the inclusion of farmers and the population, a cross-national exchange can also help to alleviate the global water crisis.

The protection of the environment and natural resources like water must be seen as a central aspect for future economic success and human well-being and existence. For this reason, a more in-depth examination of this topic needs to be done. In particular, a closer investigation of alternative water sources is recommended, as the analysis revealed some weaknesses of the current desalination plants, which are not holistically suitable for sustainable food production. Profound research has the potential for linking such technologies with renewable energy, finding a sensible, environmental-friendly solution for the filtered substances and wastewater, and enabling their flexible application. This would improve the sustainability of these projects if they were complemented by financial support to enable attractive pricing and a legal framework that prevents overconsumption of water.

Further investigations can provide extensive insights by involving other narratives, such as the local government, agriculture ministers, development banks, food producers and wholesalers. Furthermore, farmers of different cultivation approaches, such as organic farming or permaculture, could be integrated, whose expertise might enhance the overall understanding of the unity of environmental protection and economic productivity. The social level could also be further extended, including the illegal and seasonal workforce in agriculture, which is also affected by water scarcity, and elaborating on its living and working conditions and its wage system.

For sustainable development in agricultural water management, an interaction between the actors must take place, in which each individual recognises and uses his or her scope of action. Finally, it remains to be seen in which direction food production and water management will develop with regard to their ecological and economic sustainability and which theories, models, studies and investigations will prevail and be noteworthy in this area to feed a growing population in the future.

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Annexes

Annex 1: Concept Table VI
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Annex 3: Coding Paradigms XV
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Annex 1: Concept Table

No.	Concept	Interview number	Paragraph
1.	Realisation of the crisis	2 3 4 5 6 7 9 10 11	3, 7 2 3 3, 9 3, 7, 18 3 9 3 3
2.	The Mediterranean climate is not the main cause	3 6 7 9 10	6, 7 3 3 17 3
3.	There is legislation in place	2 3 6 7 9 10	4 9 4, 8, 12 5 7 5, 11
4.	Water allocation system is sophisticated & protective	2 3 8 9	3, 10, 14 4 11, 14, 23 17
5.	It is a global crisis	1 2 3 4 5 6 7 8	7 3, 23 17, 20 11 4 4 3 19

		9	7
6.	The crisis will become worse in future	2 3 4 7 9	10 2, 17 3, 12 3 18
7.	Farmers worry about their future	2 3	3, 5, 10, 14 2, 3
8.	Shrinking water resources	3 6 9 11	4, 6 4 18 22
9.	High food waste	4	30
10.	Informal norms of society	1 9	6, 19 5, 8
11.	Capitalism	1 3 4 5 6 7 9	3, 14 20, 25 12, 13, 16, 24 7 7 9 15, 19
12.	Imbalanced power structures	3 5 6 7 11	18 6 16 5 7, 19
13.	Lack of awareness	1 4 6 11	3 3, 9, 10 7, 10, 12 11
14.	No room for gathering all stakeholders together	2 3 5	17 16, 27 11

		11	18
15.	High market demand for certain products	4	3, 5, 6
16.	Low participation of some stakeholders	1 2 3 4 11	3 21 16 23 15
17.	We continue to talk in separated boxes	3	27
18.	Stakeholders focus on own interests	3 4	32 19
19.	Farmers continue with 'business as usual'	1 2 3 4 6 7 8	3 4,7 3 9,10,12,13 10,12 8 28
20.	Conflict of competencies	3 4 11	10, 11, 12 19 8
21.	Lack of control & planning – water management	6 9 11	6, 7 6 6
22.	Inferior environmental protection	3 5	9 11
23.	Households & tourism consume a lot of water	3 6	2 4, 6
24.	Water is managed reactively & unsustainably	3	7, 17
25.	Authorities do not prefer coordination	3	10, 12

26.	Continue granting long existing water rights	11	6
27.	Ensure demand while struggling with environmental protection	3 7	9, 13 3
28.	Inadequate mindset among leading positions	1 3 8 9 11	7 17, 31, 32 24 10 7
29.	Lack of human & financial resources	7	6
30.	Lack of control & planning – government	6 9 11	6, 7 6 20
31.	Low costs for water in agriculture	2 5 10 11	5 7 15, 18 23
32.	Cumbersome process to get a permit for a well	10	9
33.	Creation of unambitious laws & regulations	5 6 9	11 10 6
34.	No strict enforcement of laws	4 7	5, 6 6
35.	Political actors do not commit to sustainable development	1 3 5 7 11	7 31 11 5, 6 8
36.	Misallocation of investments	1 2 3	17, 19 12 23

		5 8	7 21
37.	Inflexible investment management	11	20
38.	Expansion of construction without any control	6	6, 7
39.	Expansion of irrigating sector without any control	3 5 6 10 11	3 9 6 20 9
40.	Construction of illegal wells	4 7 10 11	5 6 10 9
41.	Intense use of pesticides	6 11	6 4
42.	Food production without traceability & labels	4	25
43.	Green washing	4 11	24, 26 4, 24
44.	Strong lobby of irrigation sector & agriculture ministers	5 6 7 11	6 16 5 6, 7
45.	Implementation of ineffective regulations	2 3	7 26
46.	Unsustainable investments	3	20
47.	Implementation of technologies with debatable sustainability aspect	2 4 8 10 11	11, 12 11, 15, 20, 24 3, 4, 5, 6, 7, 8, 17, 19, 24 15 4, 22, 23

48.	Implementation of small projects with small scope	1 8	17, 22, 24, 26 19, 21
49.	Restructure investments & subsidies	1 2 3 4 5 6 7 8 9 11	6, 17 15 23 25 13 13, 19 12 31 15, 18, 19 23
50.	Reduce water demand	4 5 9 11	14, 17, 21, 29, 30 11, 13 18 22
51.	Higher political commitment	1 5 7 9 10	7, 9, 25 11, 13 11 11 20
52.	Regulations are necessary	1 2 4 5 6	6 7 7, 21 11, 13 10, 13
53.	Cooperation of administrations	3 4 11	10 21 17
54.	Limited opportunities of ministries	3	22
55.	Advanced technologies & knowledge	3 4 7	17, 22, 27 17, 20, 30 6

		8 10 11	3-8, 10,11,13,14,21,29 15 19
56.	Advocacy by businesses	2	8
57.	Mindshift of decision-makers & companies	2 4	15 7
58.	Farmers' cooperation	1 4	3 16, 30
59.	Quality instead of quantity	4 10	9, 14, 24, 30 7, 14
60.	Sectors that are directly affected by the crisis	3	22
61.	EU has powerful tools for sustainable development	2 3 6	7 19 16, 17
62.	Critical points of the CAP	3 6	26 12, 13, 14
63.	Consultants considering environmental matters	6	10
64.	Role as an educator & raising awareness	3 5 6 7	17 9 19 11, 12
65.	Increase cooperation	3	16
66.	Limited opportunities for NGOs or ministries	3	22
67.	Setting the mood	1 6	6, 8 18
68.	Powerful, independent individuals or groups	1 8	18, 19 26
69.	Reinforced research	8	6, 28
70.	Providing knowledge	6	17
71.	Inform the public	3	16

		4 7 8	20, 26 11 23
72.	Creation of a diversified & resilient model	3 9	23 15
73.	Co-responsibility for water management decisions	1 3	6 16, 22
74.	Improved funding opportunities for sustainable projects	8	21, 23
75.	Theory of cessation	1	5
76.	Exchange exists to a certain extent	2 3 5 9 10	3, 22 29, 30 3,4,9 3 18
77.	Constant exchange is necessary	1 2 3 4 5 6 7 9 10 11	12, 15 17, 18, 21, 22 16,25,27,32 23 11 12 8, 12 14 18 14, 15, 18
78.	Critical points of constant exchange	2 3 5 7 8	21, 24 16, 25 11 8, 9 26
79.	Potential additions to the hypothesis	1 2 3	19 17,21,23 16

		4 5 6 11	23 11 12 14,15,17,18,19

Source: Own elaboration.

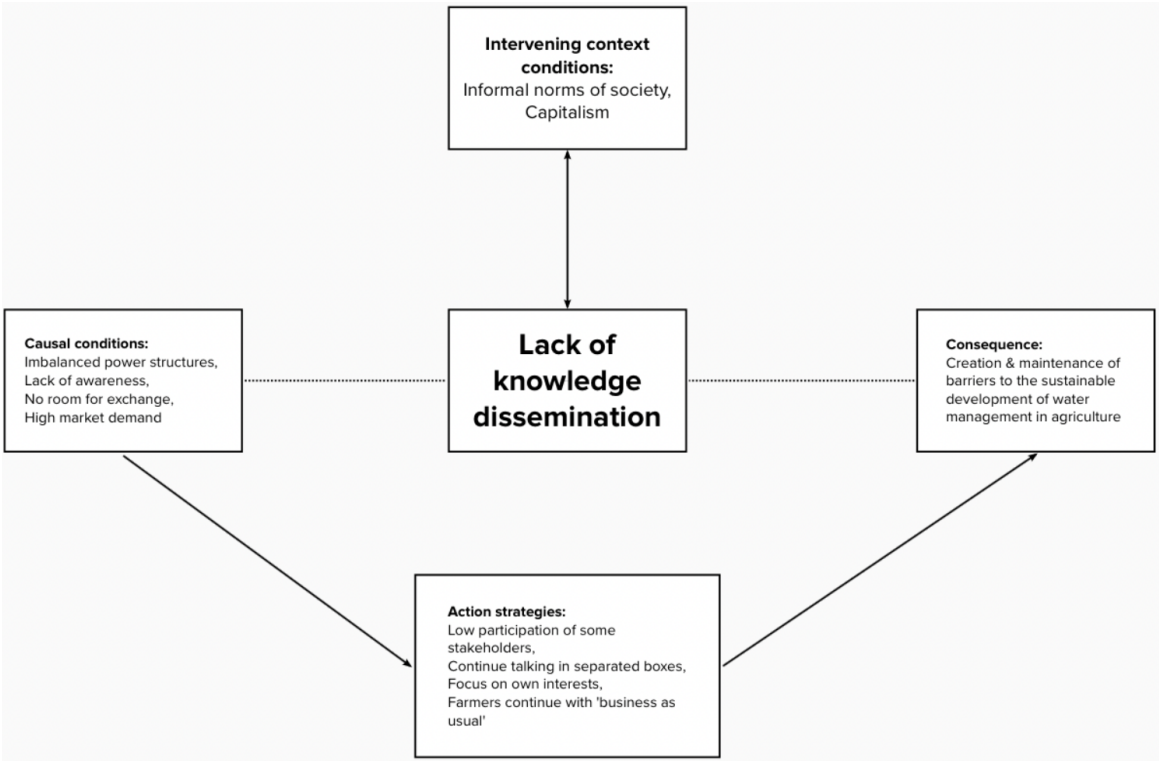
Annex 2: Category Table

No.	Category	Concept
I.	Current situation/ Consequences a. Positive aspects b. Negative aspects	 1, 2, 3, 4 5, 6, 7, 8, 9
II.	Systematic issues	10, 11
III.	Lack of knowledge dissemination	12, 13, 14,15, 16, 17, 18, 19
IV.	Complexity of water management	20, 21, 22 23, 24, 25, 26, 27
V.	Issues within the government	15, 28, 29, 30, 31, 32 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43
VI.	Issues within the EU	44, 45, 46
VII.	Insufficient implementation mechanisms	47, 48
VIII.	Opportunities for the government	49, 50, 51, 52, 53, 54
IX.	Opportunities for the private sector	55, 56, 57
X.	Opportunities for farmers	58, 59, 60
XI.	Opportunities for the EU	61, 62, 63
XII.	Opportunities for NGOs & Foundations	64, 65, 66
XIII.	Opportunities for society	67, 68
XIV.	Opportunities for scientists	69, 70
XV.	Collective opportunities	71, 72, 73, 74, 75
XVI.	An inclusive discourse & knowledge exchange as a solution a. Positive aspects b. Critical points c. Additions	 76, 77 78 79

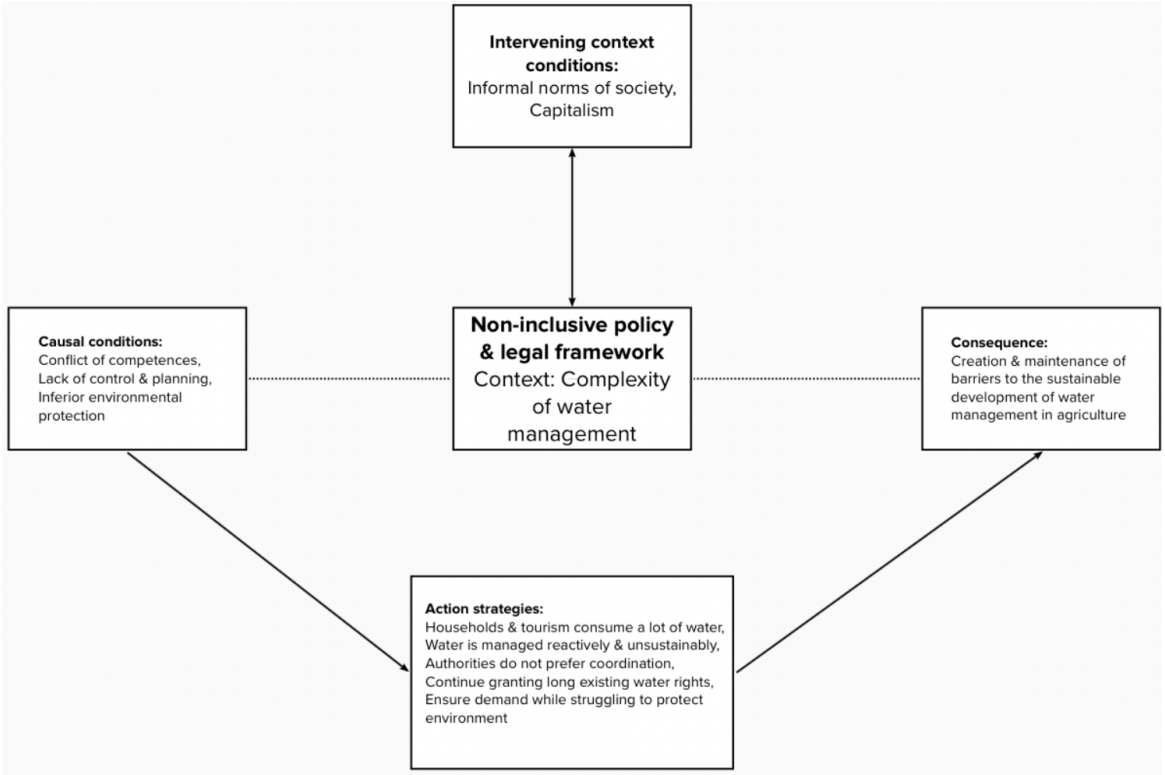
Source: Own elaboration.

Annex 3: Coding Paradigms

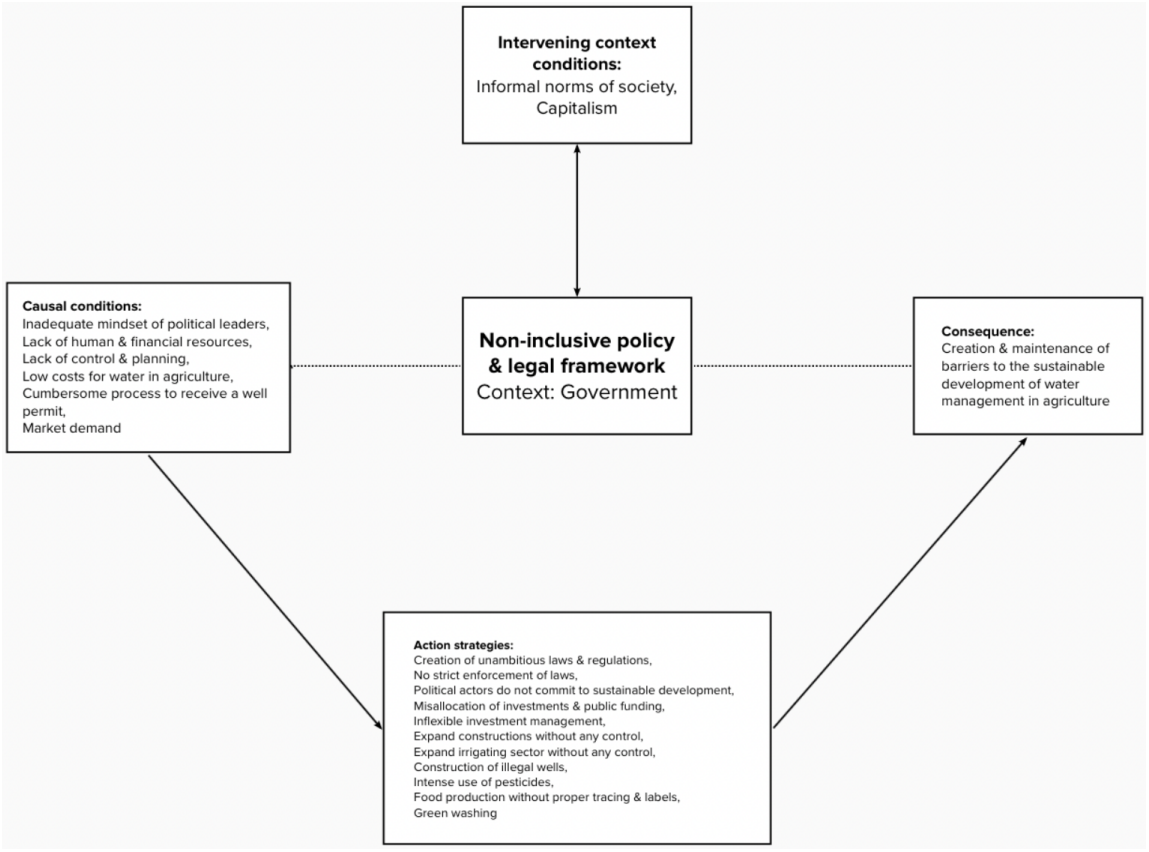
3.1 Lack of knowledge dissemination



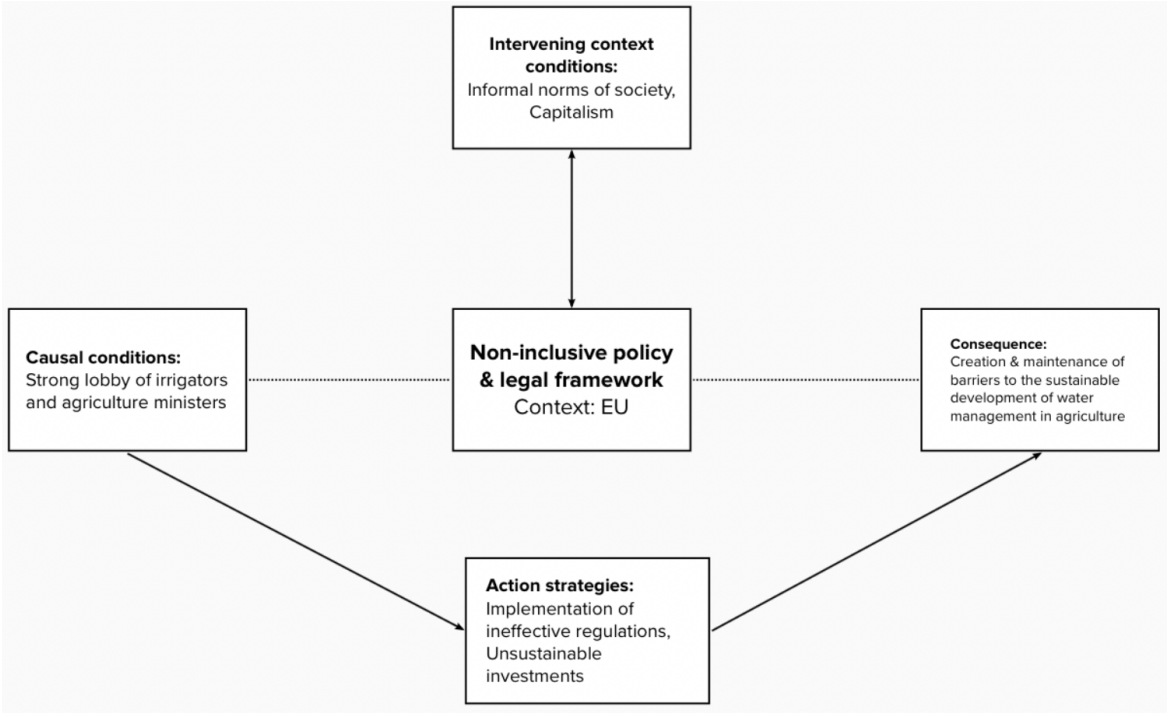
3.2 Non-inclusive policy & legal framework in the context of the water management's complexity



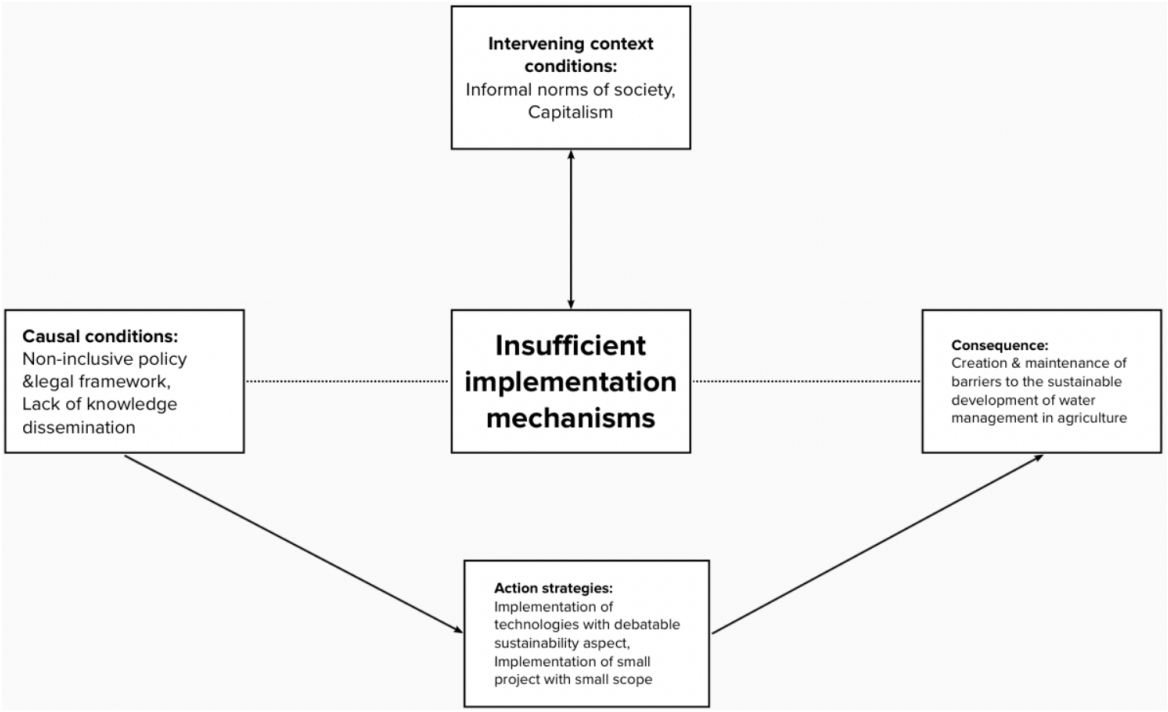
3.3 Non-inclusive policy & legal framework in the context of the government



3.4 Non-inclusive policy & legal framework in the context of the European Union

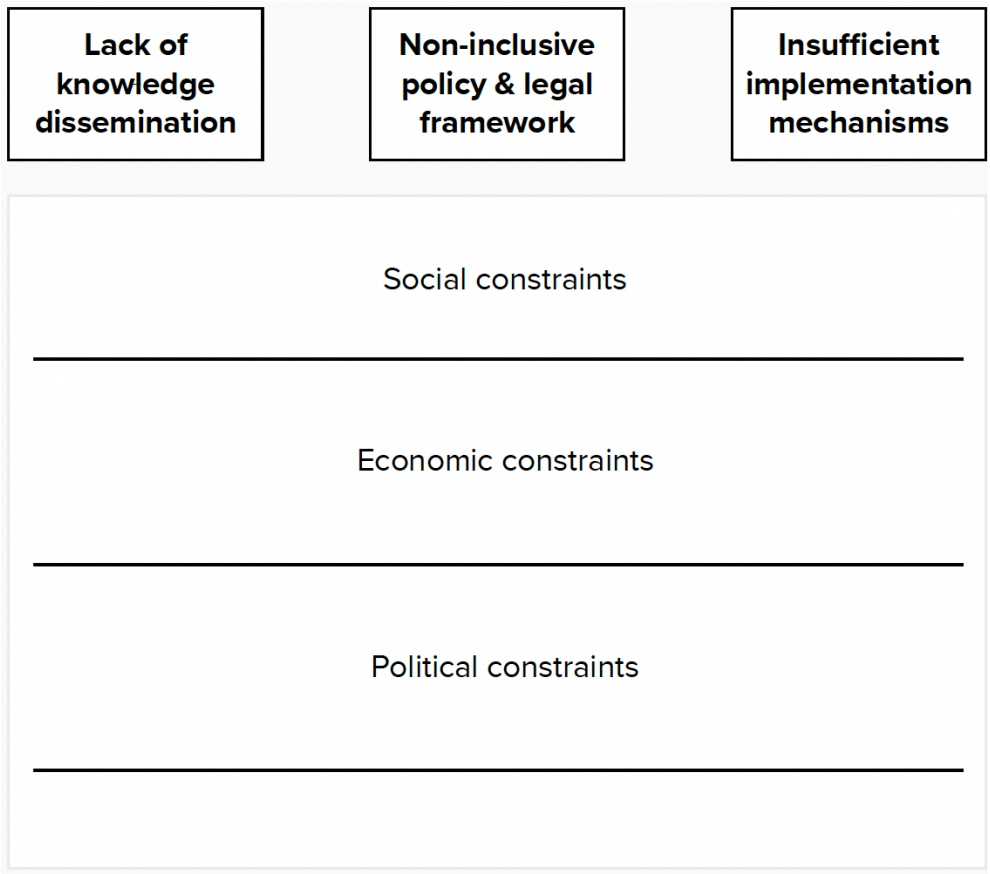


3.5 Insufficient implementation mechanisms



Source: Own elaboration.

Annex 4: Core Categories



Source: Own elaboration.