AGROECOLOGY IN THE SOUTH OF SPAIN: A GOVERNANCE PERSPECTIVE ON THE FACTORS AFFECTING THE TRANSITION TOWARDS AGRO-ECOLOGICAL FARMING.

Master Thesis Sustainable Development (EG) Utrecht University

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Preface

This thesis had been written to fulfil the graduation requirements of the Sustainable Development master program at Utrecht University. The study was supported by Commonland Foundation, an organization active in landscape restoration and the AlVelAl association, an organization in Spain active in landscape restoration on farm level. The topic of this thesis has been developed after preliminary research in the heavily degraded region of AlVelAl, the Altiplano de Granada, Alto Almanzora and Los Vélez. This preliminary research showed the need for in-depth knowledge on the barriers for farmers to make a transition towards more regenerative practice. This study was conducted between the period of October 2016 and July 2017, which included a five-month period of field work in Andalusia, Spain.

The method was based on a framework on the conditions that enable this transition, built on the work done by Runhaar et al. (2016). His approach was further developed and strengthened in this research.

I want to thank the coordinator of AlVelAl, Elvira Marín Irigaray, for including me in the team and connected me to farmers and Alfonso Chico de Guzman for hosting me on his farm and giving me the real Spanish farm experience. I also want to thank the rest of the AlVelAl team for brainstorming with me and connecting me to the right people. Furthermore I want to thank Michiel de Man, my supervisor at Commonland for showing me how to approach problems and teaching me about the business behind landscape restoration.

Last but not least, I want to thank my University supervisor, Hens Runhaar, for always being available, giving valuable feedback and for thinking together on how to make this thesis valuable.

Abstract

Agricultural land use is one of the major factors contributing to land degradation and desertification. Currently 24 billion tons of fertile soil and 12 million hectares of agricultural land are lost each year worldwide. Agro-ecological farming has a large potential for reducing land degradation. However, the implementation of this farming method is often limited by a range of barriers. AlVelAl, an ecosystem restoration association in the Spanish Altiplano, is working with farmers to restore the land and improve farm management practices, but transition on farm level is slow. Therefore this thesis determines which barriers are of importance and which interventions are needed to influence farmers' decision-making. It builds on a framework of conditions necessary for transition and explores the social, economic, political and informational factors that influence farmer decision-making, after which it analyses how a transition can be governed by the stakeholders involved.

This research was conducted in Andalusia, Spain, which has the highest desertification rate in Europe. The results show that farmers' motivation is positively influenced by being part of a community of practitioners due to the knowledge gained regarding the costs and benefits of applying agro-ecological practices. Barriers to transition are due to a lack of finances, skills, and a government and community based culture of conservatism. Demo farms and supporting agro-ecological trials by farmers, are likely to increase the adoption of agro-ecological practice. This support can be in the form of extra labour, a kick-start grant, and technical expertise.

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1. Introduction

1.1 Background

Many agricultural areas in the world have been subject to major land degradation in the last decades caused by increase of land use, poor agricultural practices, fires, and the use of pesticides and herbicides. These land use changes have increased flooding, desertification, salinization and severe degradation. According to Symeonakis et al. (2006) erosion, human induced or natural, is the most important driver of land degradation and the existence of vegetation cover is one of the main elements influencing these erosion processes (Symeonakis, Calvo-Cases, & Arnau-Rosalen, 2006).

Besides human induced land changes, climate change is also increasing the pressure on agricultural lands. Not only are many places on earth getting hotter, they are also getting dryer, with more cases of extreme weather events (Vargas-Amelin & Pindado, 2014). Keeping the lands fertile and productive is thus seen by the international community as well as by (sub) national governments as an expanding challenge which requires urgent action on all levels.

This first chapter discusses the motive for this research from an academic point of view. The chapter on 'geographical focus' discusses the practical motive behind the research and justifies the choice of the case.

Large scale intensification of agriculture and global fertilizer use have caused ''water degradation, increased energy use and widespread pollution'' (Foley et al., 2011, p. 2). Land degradation is the decline in the processes and productivity of ecosystems over an extended period of time (K. Turner, Anderson, & Gonzales-Chang, 2016). This has led to poorer soil quality (especially on agricultural lands with annual rainfall of less than 250 mm) ''because of: residues, excessive tillage, little or no application of manure and fertilizers, and excessive and uncontrolled grazing'' (Ashton, 2012, p. 25). Land degradation is thus seen as a broad problem that requires action on several levels.

Concerns and solutions regarding land degradation are multileveled and interdisciplinary. The problem is broadly acknowledged, for example by the United Nations Environmental Program who mention that: ''turning agriculture a brighter shade of green will not only ease pressure on the environment and help cope with climate change, but will also create opportunities to diversify economies, increase yields, reduce costs, and generate jobs—which will in turn help reduce poverty and increase food security'' (United Nations Environment Programme (UNEP), 2015). They are hereby linking the greening of agriculture directly to economic benefits and food security.

The Aichi Biodiversity Targets under the Convention on Biological Diversity (COP/10/INF/12/Rev.1) and the European Union's (EU) new Biodiversity Strategy (European Commission, 2012) have the aim of seeing 15% of the degraded land restored by 2020. Meaning that the ecosystem functions and the habitat are restored to their origin and that causes of degradation are eliminated (Borgström, Zachrisson, & Eckerberg, 2016).

As the EU policymakers are becoming increasingly concerned with land degradation issues and its effect on the regulating, provisioning, habitat and cultural services (EU report on Soil COM/2012/046 final), policy changes are slowly made. The Common Agricultural Policy (CAP) is the EU's main instrument to provide citizens with affordable and always available products as well as providing farmers with a stable income. The CAP combines market regulations with direct payments, greening measures, and other voluntary schemes (Regulation (EU) No 1307/2013, Regulation (EU) No 1305/2013). Since 2013 environmental elements can be found within the CAP as greening measures in the form of direct payments.

To battle land degradation one needs to consider the whole agricultural ecosystem. Agro-ecological farming is used in the academic literature to describe a way of farming that is holistic in its nature and aims at restoring rather that degrading the soil. It is based on ''various ecological processes and ecosystem services such as nutrient cycling, biological nitrogen fixation, natural regulation of pests, soil and water conservation, biodiversity conservation, and carbon sequestration'' (Wezel et al., 2014b, p. 3) with the goal of improving the sustainability of ecosystems and bringing 'environmental and economic benefits to farmers, communities and nations'. Different regenerative practices are vital to agroecology: soil cover, soil structure, biodiversity, crop diversification, limited to no tillage, swales, etc. (Kennedy & Smith, 1995; Sherwood & Uphoff, 2000; Toensmeier & Herren, 2016). All these practices can decrease land degradation and desertification in agricultural areas. In an academic context agro-ecology is used but farmers only speak about (regenerative) practices, therefore agro-ecologic farming and regenerative practices are used intertwined in this thesis.

There are quite some studies on agro-ecology, but there is still a gap between knowing about the practices needed to decrease degradation and implementing them. Therefore, this study focuses on the factors influencing decision making of farmers and the governance of these factors e.g. ''the interventions deliberately initiated in order to prevent, reduce or mitigate harmful effects of agriculture and to promote positive effects'' (Runhaar et al., 2016, p. 2). This thesis analyses which interventions are needed to take away the barriers for farmers (legitimized, motivated, able and demanded) to transition to agro-ecological farming. I expect feedback loops between the different

variables of the framework, but because of time constraints these fall outside the scope of this research.

The research questions are based on the framework of Runhaar et al. (2016), see Figure 1. The first question focuses on the four conditions necessary in the decision-making of farmers regarding a transition to agro-ecological farming: motivation, demand, ability and legitimation. The availability of these conditions in turn, are influenced by economic, social, informational and political factors (see Figure 2). The factors influencing this transition probably differ per context and are therefore central to this research.

Figure 1: Framework on necessary conditions. Source: Runhaar et al. (2016)

As this framework has only been used in the Netherlands until now, it can be further strengthened and validated by using it in the South of Spain. Therefore, this study is, besides being practise oriented, also contributing to strengthening the theory on conditions for transitioning (Runhaar et al., 2016).

What are the factors that influence the decision-making of farmers to transition to agro-ecological farming in the region of Andalusia?

The second research question focuses on the ways this transition can be steered by stakeholders. This part of the research analyses which interventions are needed to steer directly on the conditions, or indirectly on the factors. Interventions can be carried out by different stakeholders; NGO's, businesses, and by the government.

How can these factors and/or conditions in turn be influenced by stakeholders?

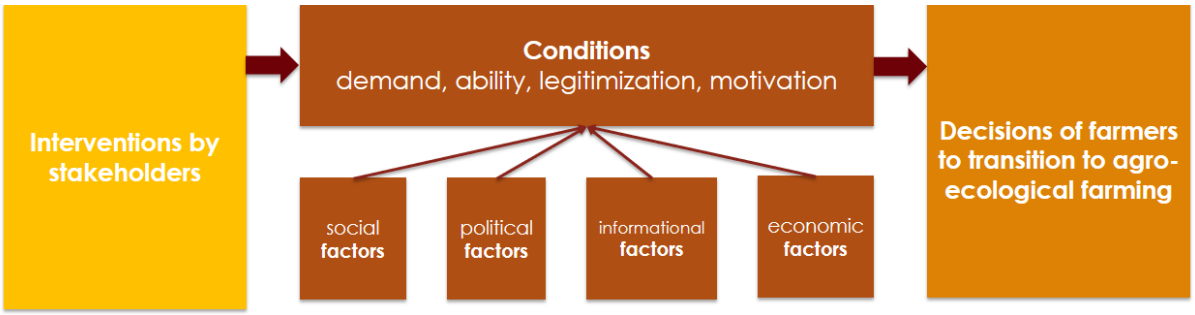

Figure 2: Framework of concepts

1.2 Geographical focus

This sub-chapter discusses the practical motivation behind this research and the reasons behind the geographical focus of Andalusia.

Within Europe semi-dry and dry areas bear most of the challenges when it comes to environmental problems (Zdruli, 2014). Spain is one of the countries, besides Italy, Portugal and Greece, that has the highest desertification rates and water scarcity issues (European Parliament, 2009; Vargas-Amelin & Pindado, 2014). According to the European Commission land degradation in the Mediterranean threatens food security as 30% of the semi-dry areas have been affected by desertification and by 2020 8.3 million hectares of agricultural land will be lost (Zdruli, 2014).

For a long time now, Spain has seen its lands degraded as intensive farming and overgrazing have caused large-scale degradation as is also visible in the photo below (Reynolds, Maestre, Kemp, Stafford-Smith, & Lambin, 2007). Conventional farming practices are causing many problems in the region which is already one of the poorer regions in Europe.

Photo 1: Heavily degraded olive orchard near Jaen: no ground cover, high levels of run-off, monoculture. All photos are from own collection.

The situation in Spain has been researched before with academics focusing on the ecological problems and solutions (Holland, 2004; Hugo et al., 2008; Kassam et al., 2012; Vadell, De-Miguel, & Pemán, 2016), while others focus on the social aspects (Calatrava, Barberá, & Castillo, 2011; Oñate & Peco, 2005; Sánchez, Álvaro-Fuentes, Cunningham, & Iglesias, 2014b). According to a literature review by García-Ruiz (2010) the greatest soil losses in orchards in Spain were seen with soils that had a herbicide treatment and the least soil loss was seen with vineyards that were covered with herbs (8.5 Mg ha− 1 yr− 1 against 1.2 Mg ha− 1 yr− 1 and 2.5%) (García-Ruiz, 2010). Not only are the lands eroding at a fast pace, soils are increasingly losing nutritional value with organic matter approaching close to zero (García-Ruiz, 2010).

The preliminary interviews with employees of Commonland, an international landscape restoration NGO, and AlVelAl, a local landscape restoration association, brought forward several issues which gave reason to research the factors influencing decision-making by farmers. The gap that materialized by conducting these interviews was a lack of insight in the obstacles for transitioning towards regenerative practices and a need to increase understanding for NGO's, government and businesses to steer their behaviour towards this. The regenerative activities AlVelAl stimulates have proven to benefit the restoration of land (see chapter on theoretical framework), but only five of the sixty involved farmers have adopted the practices in the past two years in the region of Los Velez, the Altiplano of Granada, Jaen, and Northwest of Murcia (now also abbreviated as the AlVelAl region). This complex issue requires rethinking of the tension between the current and the desired situation as well as diagnosing the causes for (in)action. Knowledge is needed to pinpoint the decisive decision-making factors to develop successful interventions that can change a degraded system into a system that is restored, healthy and flourishing.

1.3 Research objectives and research questions

The aim of this research is twofold. First, it aims at identifying the factors promoting and hindering the transition to agro-ecological farming in Andalusia. The factors are then connected to the conditions mentioned by Runhaar et al. (2016). Secondly, possible interventions are developed to steer the transition more effectively and take away the factors that hinder this transition. Interventions are the courses of action taken by AlVelAl, the government, or businesses in order to steer on the decision-making as to achieve the goal of landscape restoration in the South of Spain. To identify the factors and develop possible interventions, the following research questions and sub-questions are developed, based on Verschuren, Doorewaard & Mellion (2010). A second goal is to strengthen the theory on conditions as developed by Runhaar et al. (2016). Below the research questions are written down.

Main research questions

- What are the factors that influence the decision-making of farmers to transition to agro-ecological farming in the region of Andalusia?
- How can these factors in turn be influenced by stakeholders?

Diagnosis

- **What determines the decision-making of farmers to transition to agro-ecological farming?**
- How are the conditions of Runhaar et al. (2016) present in Andalusia?
- Which specific factors, identified from the literature, influence farmers' decision-making and how are these present in Andalusia?

Interventions

- **How to influence farmers' decision-making to transition to agro-ecological farming?**
- What interventions, identified from the literature, steer the decision-making of farmers and what do farmers themselves see as feasible interventions?

In the following section I discuss the theoretical framework consisting of the dependent and independent variables. The third chapter explains the research design including the strategy, method, and data. The fourth chapter contains the introduction to the case. The fifth chapter discusses the results from the interviews. The last segment contains a discussion; conclusions are drawn and recommendations are made.

2. Theoretical framework

In this section I discuss the theory behind the dependent and independent variables as well as my additions to it. The theoretical framework reflects how the literature suggests the dependent and independent variables are defined, combined with reflections from discussions with farmers and experts during the preliminary study. From this analysis, the results are interpreted. The second part of the theoretical framework discusses the literature on types of interventions and how they can influence the decision-making process of farmers.

The theoretical framework has been derived from Runhaar et al. (2016) and updated with own additions. Conditions have stayed the same but their operationalization has been altered to fit the questions at hand. The factors that have been used have been extracted from institutional literature, agro-ecological literature and agro-governance literature. Unlike the framework of Runhaar et al. (2016), who has divided his factors into 'governance arrangements, context and characteristics of farmers', the new theoretical framework mentions that there are four types of factors that influence the conditions: social, economic, informational and political factors.

2.1 Dependent variable: transition to agro-ecological farming

The dependent variable is the transition to agro-ecological farming. This chapter analyses the literature on agro-ecological farming and discusses which practices are considered most important.

As D.J. Pannell already mentioned in 1999, it is very difficult to get farmers to radically change their way of farming towards an innovative and sustainable farming system. This change often only happens when it coincides with an extreme opportunity or an extreme problem. The implementation of a new farming system will often depend on farmers' reactions to external interventions (Pannell, 1999). The extreme problem of land degradation and desertification is in this case a problem that has come to being only gradually and is thus not something farmers see as needing an immediate fix.

Land degradation is an multi-faceted problem requiring action that needs a solution that is holistic in nature according to Ferwerda (2015), Kremen (2012), and Garbach et a. 2016. According to Liu et al. (2015) ''holistic approaches are critical to understand the socioeconomic and environmental interconnections and to create sustainability solutions'' (Liu et al., 2015, p. 965).

Although sustainable land management is widely used, it is also subject to many irregularities in its definition. 'sustainable' might mean something entirely different from a biologist then from a sociologist point of view. Agroecology is therefore chosen instead, as explaining the most complete

and holistic way of farming, taking into account the whole ecosystem and without the differences in meaning (Altieri, 2002; Cuéllar-Padilla & Calle-Collado, 2011; Kremen, Iles, Bacon, & Bacon, 2012). Although this word will be used in this research, it is not used by the farmers themselves. They often do not have a name for how they manage the farm, except for conventional or ecological. Therefore, the questions are based on the specific practices farmers use which are later termed 'regenerative' or not regenerative. Table 1 discusses the different definitions of forms of sustainable land management.

Agroecology is an emerging topic in the literature as it has only first been mentioned in 1979 by Coleman (1979) after which Altieri (1989) and Gliessman (1990) have developed the concept further (Altieri, 1989; S. R. Gliessman, 1990). Wezel (2014) states that agro-ecological practices: ''draw on natural ecosystem functions to improve efficiency, substitute inputs and reorganize farming systems'' (Isgren, 2016; see also Wezel et al., 2014a). Pearson (2007) speaks about the need for regenerative semi-closed systems in order to battle degradation (Pearson, 2007). Sherwood & Uphoff (2000) have defined it as practices to maintain and improve the regenerative capacity of our production systems (Sherwood & Uphoff, 2000) hereby especially referring to soil functioning and health.

Common ground can be found with other types of sustainable land use systems like conservation agriculture, sustainable agriculture, carbon farming and others. The most frequently mentioned authors in Scopus, and the practices they discuss, are mentioned in the table below. This table explains which elements are mentioned by whom and under which definition. Shared elements are zero tillage, crop rotation, biodiversity, irrigation practices, and natural pest control.

Definition	Author	Characteristics
Agro-ecology	(Wezel et al., 2014a)	crop rotations, crop fertilisation, weed pest and disease management, redesign practices, tillage management, management of landscape elements
	(Altieri, 2002)	nutrient recycling, soil biological activity, natural control mechanisms, resource conservation and regeneration, general enhancement of biodiversity
	(Gliessman, 2016)	efficient use of pesticides, precise use of water, cover crops, nitrogen fixing crops, natural control systems, organic compost, agroforestry, integration of animals, rotations
Carbon farming	(Smith, 2004)	zero tillage, set-aside, permanent crops, compost, rotations, fertilization, irrigation, organic farming, cropland to grassland or woodland
	(Smith & Olesen, 2010)	plantations, agroforestry, re-vegetation
Sustainable agriculture	(Pretty, 2008)	nutrient recycling, minimize harmful inputs, watershed management, conservation tillage, agroforestry, water harvesting, aquaculture, livestock integration
	(Sánchez, Álvaro-Fuentes, Cunningham, & Iglesias, 2014a)	cover crops, reduced/no tillage, fertilization with animal manure, optimized fertilization, crop rotations, intercropping
	(Pimentel, 2003; Wen & Pimentel, 1992)	crop rotation, intercropping, minimum tillage, organic fertilizer, animal husbandry, agroforestry, composting
	(R. Lal, 2004; Rattan Lal, 2009)	soil and water conservation, biodiversity, improving soil structure, recycling nutrients
Conservation agriculture	(Govaerts et al., 2009)	reduced tillage, retention of residues on soil surface, crop rotations
	(Lal, 2004)	soil restoration and woodland regeneration, no-till farming, cover crops, nutrient management, manuring and sludge application, improved grazing, water conservation and harvesting, efficient irrigation, agroforestry practices, and growing energy crops on spare lands

Table 1: Definitions according to the literature

While table 1 shows the research done on the different types of sustainable farming, table 2 shows the specific practices belonging to agro-ecological farming, categorizing them in four elements: water, soil, trees, and diversification measures. As is visualised in the figure below, agroecology exists of

several regenerative practices which are all designed to restore degraded agricultural land, they are categorized in water, soils, tree and diversification measures. This figure is based on research done by several researchers (see Table 1) and combined with knowledge that the NGO Commonland has gathered over the years.

	practice	effects	economic impacts	ecological impact		
				soil	water	biodiv.
Water infrastructure	Earth works (swales; dams)	Increase water availability; reduce run-off and erosion	+	+-	++	+
	Wind breaks; hedges		-	+	+-	+
	Sustainable irrigation		++	+	+	+
Soil management	Vegetation cover	Increase fertility through nutrients, microorganisms and soil organic content, reduce erosion, increase infiltration, reduce evaporation	+-	++	++	++
	Compost, mulching & manure		++	++	+	+
	Nitrogen-fixing crops		+-	++	+-	+-
	Reduced / no tilling		+	++	+	++
Tree mgmt	Integrated pest management	Reduce need for synthetic pesticides	+	+	+-	++
	Sustainable phytosanitary management		-	+	+-	++
Diversifi-cation	Crop diversity: Aromatics, Cereals	Income and biodiversity gains from diversified operations and establishing of eco-corridors	++	+	+	+
	Livestock integration		+	++	-	+-
	Mosaic landscape planning		+-	+	-	++

Table 2: Regenerative practices. Source: Commonland

Certain elements are seen as most important to restore degraded agricultural lands. They can be divided in 4 main categories: diversification (Kremen, Iles, Bacon, & Bacon, 2012; Kremen & Miles, 2012; Pala, Ryan, Zhang, Singh, & Harris, 2007; Sánchez et al., 2014), tree management (Pearson, 2007; Rigueiro Rodríguez, McAdam, & Mosquera-Losada, 2009; Sánchez et al., 2014a; Sayer et al., 2013), soil management (Abawi, Thurston, & Thurston, 1994; Holland, 2004; Kennedy & Smith, 1995; Sherwood & Uphoff, 2000; Soane et al., 2012) and water infrastructure (Kremen et al., 2012; Lopes et al., 2011; Toensmeier & Herren, 2016). The measures are focused on decreasing land degradation which requires action on several levels: decreasing erosion, increasing fertility, increasing infiltration of water and increasing biodiversity. The long term economic impacts of these practices are considered to be positive although wind breaks and sustainable phytosanitary management are costly and do not have clear (short term) economic benefits. The ecological impact has been measured looking specifically at soil, water and biodiversity with vegetation cover and reduced/no tilling as having the most clearly visible positive effect.

Photo 2: Biodiversity on an almond orchard in El Contador: according to farmers the presence of beetles is a good sign

2.2 Independent variables: conditions

Conditions are the necessary prerequisites for transitioning to agro-ecological farming. In this thesis the conditions developed by Runhaar et al. (2016) are applied: motivation, demand, legitimation and ability. The conditions are influenced by certain factors. Interventions then, can directly influence these conditions, or indirectly, through the factors mentioned above. The factors influencing these conditions are refined by clustering them into four categories: informational, political, economic and social.

The framework, see figure 3, is vertically divided into internal conditions (motivation and ability) and external conditions (demand and legitimation). This division explains if the decision making of farmers comes from within the farmers themselves or is influenced mainly by other actors. The horizontal division consists of the why (motivation and demand) and the how (ability and legitimation).

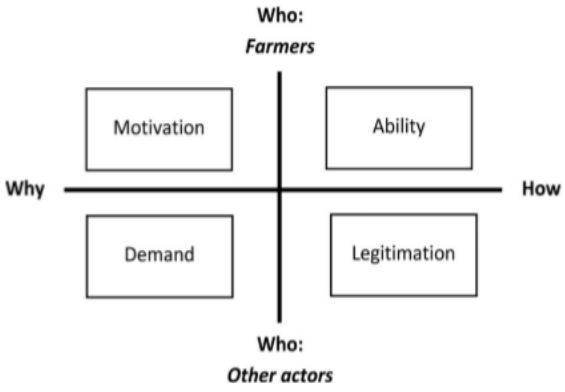

Figure 3: Framework Runhaar et al. (2016)

Within the literature on agroecology, there are only a few articles which discuss the conditions necessary for governing a transition. For example, Sherwood & Uphoff (2000) discuss how to increase

farmer leadership and thereby rural development, by using institutional and policy factors, and the underlying praxeologies underpinning innovation by farmers (Sherwood & Uphoff, 2000). According to Kremen (2012) more institutional support is needed to push the transition forward. But, most of the article is focused on the agro-ecological side and less on governance. Enabling conditions for implementing farm management are also discussed by Hart et al. (2015). They mention that enabling conditions can be economic; in the form of mobilization of markets, social; in the form of partnerships, networks and support from NGO's, and knowledge and information sharing (Hart, McMichael, Milder, & Scherr, 2016). These factors are similar to the ones discussed by Runhaar et al. (2016) and Pannel (1999).

2.3 Independent variables: factors

One of the goals of this research is to define the factors affecting the conditions for transitioning to agro-ecological farming in the AlVelAl region. The factors are first divided into social, economic, political and informational factors (DeLonge, Miles, & Carlisle, 2016; Isgren, 2016; Prokopy, Floress, Klotthor-Weinkauf, & Baumgart-Getz, 2008a; Sánchez et al., 2014a) after which they are further operationalized (See Annex 2). Each factor can influence each condition. For example: information (skills) can influence the ability of farmers to implement a practice and information about the benefits of a practice can legitimize the use of a practice (table 3 shows the operationalization of the factors). The division of the factors is based on a review of institutional literature, agro-ecology literature, and agro-governance literature which have been chosen as an appropriate angle for developing this theoretical framework.

Most authors agree that information and knowledge play an important role. Knowledge is mentioned as one of the key factors by Isgren, D'Souza, Lalani, and Carlisle (Carlisle, 2016; D'Souza & Phipps, 1993; Isgren, 2016; Lalani, Dorward, Holloway, & Wauters, 2016). While education is dismissed as having a significant effect by Lalani et al. (2016) who say that farm characteristics and socio-demographics are found to be insignificant. Carlisle (2016) on the other hand states that, although most demographic factors are insignificant, education, age and gender are important. This is contradicted by Nave et al. (2013) who state that, opposite to earlier studies, this study does not find any relation between age and transition (Nave, Jacquet, & Jeuffroy, 2013). Within this thesis it was expected that age plays role, as the preliminary interviews suggested that ''old people are more weary of change'' (A. Chico de Guzman, personal communication, 04-11-2016). Also, it was expected that the lack of understanding of the problems at hand and of the ecosystem plays a role in the decision-making process of farmers.

A second factor that is often mentioned in the literature is related to politics. According to Isgren (2016) some policies looked good on paper but appeared to be difficult to implement on local level. Sanchez (2014), D'Souza (1993) and Carlisle (2016) also mention policy, but then mainly subsidies and rules and regulations as important factors in the adoption of conservation practices (Carlisle, 2016; D'Souza & Phipps, 1993; Sánchez et al., 2014a). Other authors do not mention policy factors at all (Knowler & Bradshaw, 2007; Wauters & Mathijs, 2014). In the case of this research policy and politics are considered in the same box. Subsidies are considered to be economic incentives coming from political pressure.

A third factor which becomes visible after analysing the literature are the economic factors. These are often mentioned as being financial factors (Carlisle, 2016; Knowler & Bradshaw, 2007; Wauters & Mathijs, 2014) or economic incentives (Isgren, 2016). Sufficient financial wellbeing (Clay, Reardon, & Kangasniemi, 1998; Gould, Saupe, & Klemme, 1989; Neill & Lee, 2001; Saltiel, Bauder, & Palakovich, 2010) is said to have a positive effect on the adaptation of new farming practices.

The perceived costs and benefits of trying a new practice also influence a farmers' decision. The willingness to try out regenerative practices depend on the perceived success rate of implementation (Pannell, 1999). This said, according to Pannell (1999) the primary reason for farmers to adopt a new farming system depends foremost on economic factors and the best way to overcome land degradation is by making sure that regenerative practices are profitable.

The fourth factor is the social or cultural factor. Lalani and Carlisle (2016) write on social factors being related to social pressure, perceptions, recognition and norms and values (Carlisle, 2016; Lalani et al., 2016). Prokopy (2008) on the other hand uses the word 'attitude' to describe heritage and attitude (Prokopy et al., 2008a). Isgren (2016) also does not use the word social, but instead discusses 'ideology' and the perceptions on backwardness and modernity related to agriculture (Isgren, 2016). Both Lalani (2016) and Knowler (2007) mention that is matters if a farmer is a member of a farmers group (Knowler & Bradshaw, 2007; Lalani et al., 2016) which will be categorized under the social factor. Social factors, like connectedness to others, can positively influence the adoption of new practices (Pretty & Ward, 2001; Warriner & Moul, 1992). Also, the amount of knowledge sharing and information available can play a vital role (Nowak, 1987; Pereira De Herrera & Sain, 1991; Prokopy, Floress, Klotthor-Weinkauf, & Baumgart-Getz, 2008b; Traore, Landry, & Amara, 1998; Westra & Olson, 1997).

The table below shows the framework as has been developed from the literature and the division of factors and their operationalization. The factors influence the availability of the conditions.

Conditions/factors and operationalisations of the framework

Conditions	Explanation	Factors	Operationalization
Motivation	extent to which farmers are motivated to participate in agro-ecological practices	Economic	Impact of measures on primary processes
			Cost benefits
			Investment possibilities
		Social	Recognition
			Rewards
			Degree of autonomy in choosing and implementing results
			Values
			Peer pressure
		Informational	Education
			Training
			Understanding of the farm ecosystem
		Political	Bureaucracy
			Corruption in government
Ability	Extent to which farmers are capable to act within, or enabled by an agro-ecological practise	Economic	Availability of new business models
			Available finances
			Market conditions
		Social	Peer pressure
			Values
			Community support/trust
		Informational	Skills
			Farming style
			Communities of practise
			Research
			Learning
			Information about benefits
		Political	Involvement of NGO's
			Support from government
Demand	Extent to which farmers are requested or obliged to participate in agro-ecological practices	Economic	Environmental/market regulations
			Demand for sustainable products
			Conditions in contracts with customers
		Social	Public opinion about agriculture
			Religious values
			Peer pressure
		Informational	Understanding of request to do regenerative practices
		Political	Pressure from NGO's
			EU CAP subsidies
			Pressure from government
Legitimacy	Extent to which farmers are allowed to participate in, and act within, agro-ecological farming	Economic	Degree of freedom with contracts/legislation
		Social	Norms
			Social control
			Peer pressure
			Cultural setting
		Informational	Innovativeness
			Community of farmers
		Political	strictness of legislation and standards
			Indirect effect of adjacent policies
			Framing of agriculture in policy and communication

Table 3: Conditions, factors and their operationalisations

2.4 Interventions

In this subchapter, the different courses of action, or interventions are discussed. The courses of action are mentioned in Verschuren et al. (2010) as belonging to the diagnostic phase of a research. Interventions refer to the actions aimed at solving societal problems (Runhaar et al., 2016). They are focused on the factors and conditions mentioned earlier in the theoretical framework. Factors that positively influence behaviour, like community feeling for example, can be reinforced by certain interventions, while obstructing factors, like adjacent policies, need to be reduced.

There are several interventions to steer decision-making of farmers which are based upon the framework of Driessen et al. (2012) who distinguishes five modes of governance: centralized, decentralized, public-private, interactive and self-governance. In this case the five modes of governance are shortened to three steering approaches: top-down, interactive and self-governance (Driessen et al., 2012; Runhaar et al., 2016). Interventions themselves can act as factors influencing decision making, as is for example the case with the subsidies of the CAP, they are both a political factor and a top down political intervention.

Table 4 shows the different interventions possible according to the literature categorized in top down, interactive and self-governing interventions. The following paragraphs discuss some of the interventions that come forward from the literature most clearly; focussing on communities of farmers, financial incentives, and educational programs.

Hart et al. (2016) discuss self-organizing producer groups who can influence the system and implement multi-functional farming systems. The organization of these groups depends highly on the motivation, vision and feeling of responsibility of farmers. Interventions to stimulate these groups can take place in politics: favouring certain practices over others, providing technical assistance and key stakeholders being willing to grant space on the negotiating table (Hart et al., 2016, p. 319).

According to Sánchez et al. (2014) the main barriers to adaptation are related to environmental concerns, financial incentives and the availability of technical advice, which can be influenced by setting up agri-environmental cooperatives. Their recommendations are that accessibility to policy and technical information are key to steer a transition (Sánchez et al., 2014b). This is similar to statements made by Runhaar et al. (2016), Borgstrom et al. (2016) and Baker (2013) who all see farmer cooperation/networks/community as central to bottom-up implementation.

Pannel (1999) sees extra labour as one of the main interventions for stimulating innovativeness and trials done by farmers. The intervention deals with the obstacles of high costs in both money and time for doing a risky experiment (Pannell, 1999). Besides extra labour, other financial and political interventions are considered to stimulate the transition of farmers. According to Stonehouse (1996)

top down interventions, such as targeted policies and funding, are needed because voluntary instruments have proven insufficient in increasing conservation measures by farmers (Stonehouse, 1996).

Other courses of action are more socially focussed; like educational programs, creating awareness and providing unambiguous information. These interventions are often either top down or interactive in nature. They are developed to conquer barriers like a lack of knowledge on the costs and benefits of practices or lack of skills. According to Uri (1998) educational activities can serve to demonstrate practices and to provide detailed information about its costs and benefits. This can be followed up by one-on-one technical assistance in order to benefit most (Uri, 1998).

Interventions		
Top down governance	**Interactive governance**	**Self governance**
Subsidies (CAP), taxes (K. G. Turner et al., 2016), Legislation	Promotion of ecological products (demand) (Hart et al., 2016)	Supply chain governance (Driessen, Dieperink, van Laerhoven, Runhaar, & Vermeulen, 2011)
Grants (Stonehouse, 1996)	Performance contracts (Driessen et al., 2012)	Machine rentals (Erenstein, Sayre, Wall, Hellin, & Dixon, 2012)
Risk coping mechanisms (Kassam et al., 2012)	Norms and standards (Ahnström et al., 2009)	Agri-environmental cooperatives (Sánchez et al., 2014a)
Payment Ecological Services (PES) (Engel S., Pagiola S., 2008)	Taxes (K. G. Turner et al., 2016), Grants (Stonehouse, 1996)	Acquisition of funding by NGOs (Ferwerda, 2015)
Parallel investments in social capital (Knowler & Bradshaw, 2007)	Payment Ecological Services (PES) (Engel S., Pagiola S., 2008)	Development of new business models (Ferwerda, 2015)
Create norms and standards (Ahnström et al., 2009)	Partnerships between stakeholders (Hart et al., 2016; Runhaar et al., 2016)	Creating farmers groups, community building (Borgström et al., 2016)
Targeted promotions, awareness and educational programs (Uri, 1998)	Framing of sustainable agriculture by government and business (Driessen et al., 2011)	Voluntary instruments: voluntary commitments towards goals (Borgström et al., 2016)
Unambiguous information (Knowler & Bradshaw, 2007)	Investments in social capital (Borgström et al., 2016)	Communities of practise (Runhaar et al., 2016)
Technical assistance (Meyer, 2009; Uri, 1998)	Educational programs (Uri, 1998)	Labelling and reporting (Driessen et al., 2011)
	Information about costs-benefits (Sánchez et al., 2014a)	Self-crafted (and self- imposed) rules (Driessen et al., 2011)
	Technical assistance (Meyer, 2009; Uri, 1998)	Work together with other farmers to influence legislation (Baker & Eckerberg, 2013)
	Provide extra labour (Pannel, 1999)	

Table 4: Interventions as found in the literature

The interventions discussed above are matched with the factors and conditions mentioned earlier in the theoretical framework. Each factor can be influenced by several interventions according to the literature. The table showing these connections and specifications has been put in Annex 6 because it is too big to show here.

3. Methodology

3.1 Research strategy

The research strategy is built on a combination of empirical and theoretical elements, using multiple methods as is suggested in the book on research design by Verschuren et al. (2010). The main characteristics of the research strategy are an in depth qualitative research, semi-structured in a single case study. First the problem is analysed with desk research to get a grip on the context in which farmers operate. Secondly, interviews are used to understand the obstacles and motivations for farmers to transition to agro-ecological farming. Thirdly, possible interventions are developed by combining the literature and informal discussions with farmers.

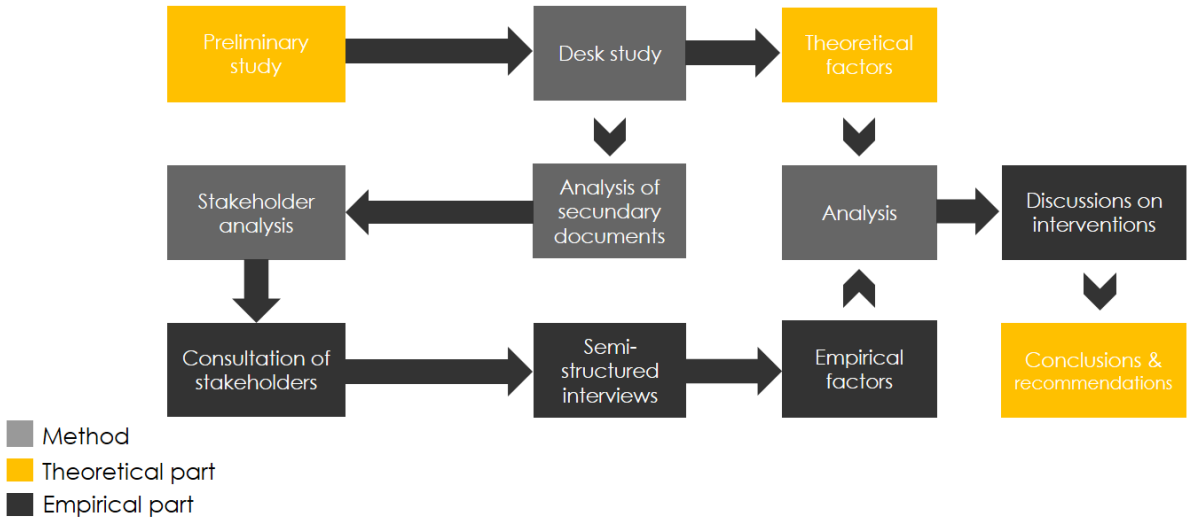

Figure 4: Research framework

The research was initially set up as a comparative case study in which thirty farmers were interviewed and open observations on site were gathered in order to understand the context in which people live. Data were gathered using a triangulation of methods in order to strengthen the viability and reliability of the research (Doorewaard & Verschuren, 2010, p. 161) and to see if the challenges and barriers differ per farmer and are generally applicable. The groups were initially divided regarding the amount of regenerative practices done per farmer.

With in-depth interviews (see Annex 1) it was possible to get elaborate information on how decision-making is influenced by several factors and what conditions were present. This would have been less easy with surveys because farmers often had to ease into the topic and the most interesting arguments were only made after two hours of talking. To analyse the results, I used both qualitative and quantitative analysis. For the quantitative analysis, the interviews were coded by decision-making

factor, after which they were categorized according to condition (for more in depth information about how the method is used (see Annex 2). The quantitative analysis was merely for own understanding and to visualize the results because of the small sample taken.

3.2 Data collection

The first research question analyses the problem at hand by using academic literature, interviews and personal observations. The second research question aims at finding interventions which are taken from the governance literature and group discussions with farmers. Below the different types of data collection are described.

3.2.1 Desk research

Research papers

Scientific literature on the problem of land degradation and its impact in the south of Spain, as well as on the desired situation and the details of agro-ecological farming were analysed in order to get a grip on the context in which the research takes place.

The literature also identified the different conditions necessary to make this change and how this is influenced by several factors. In a later stage desk research was needed to review literature on possible interventions as mentioned in the institutional literature, agro-ecological literature and agro-governance literature. To gain a fast overview of all the conditions and factors mentioned in the literature, literature reviews were consulted. In the online search on Scopus and Scholar the following terms were used: 'regenerative farming', 'land degradation', 'farming practices', 'decision-making farmers', 'governance' and 'desertification'. Once the main problem was determined from the literature, this was checked for accuracy with members from Commonland and the AlVelAl organization.

Publications of the EU

The documents found on the website of the EU were of great importance in understanding the subsidy system in which the farmers in the EU, but specifically Spain, Andalusia, operate. These documents, varying from regulations to yearly evaluation reports, are used in the explanation of the case study as well as in the explanation of the independent variables. Search words that were used were: 'Common

Agricultural Policy', 'CAP', 'greening measures', 'rural development program' and 'Program Desarrollo Rural Andalusia'.

National Statistics Institute Spain

The national statistics institute Spain and its website INE.SE was very helpful in analysing farm characteristics which must be considered when interviewing farmers. The website had large data collections on agro-ecological practices already implemented, the juridical system, and which subsidies have been used. These data were extracted in excel forms and transformed into graphs to explain the case study more clearly and strengthen the problem definition.

3.2.2 Field research

Empirical conditions were analysed by interviewing stakeholders within the AlVelAl region. Interviewees were farmers, and for extra information experts and members of Commonland and AlVelAl were contacted. The next step was a comparison between the theory and the empirical results from which recommendations were developed. As the sample consisted of thirty farmers it is considered a small sample, therefore connections are made only between the elements of the sample. An analysis was made of how the barriers are connected to the characteristics of farmers and to the amount of practices done to check for any correlations.

The conditions and factors found in the first part of the research project were used and compared to the empirical evidence found later in the research. Semi-structured interviews were most efficient taking the language barrier into account. Although the interviews were semi-structured there was room for more informal talk. Farmers from the AlVelAl region were interviewed adding up to a total of thirty farmers. These farmers were contacted through the AlVelAl organization, local farmers associations and by using the snowball method (Wasserman & Faust, 1994), hereby including the amount of regenerative practices, size and age. In this case study the focus was on farmers with more than ten hectares of arable land. Although the farmers were initially chosen looking at conventional versus agro-ecological farmers (see table 3), later in the process this division appeared not to be functional, after which the groups were combined (see Annex 5). Because farmers were contacted through AlVelAl they were more likely to be already interested in, or encountered, regenerative practices, making the group more susceptible to bias. The snowball method used to identify more farmers could have sustained this bias.

To introduce the topic of agroecology to farmers it was necessary to use an explanation of agro-ecology which farmers could relate to, which resulted in talking about practices instead of agro-ecologic farming. The interviewees were asked about their current practices, which regenerative practices they see as important, why these are important, why they implement these practices, what influences their decisions and which barriers they face in using agro-ecological practices. Interviews were held in Spanish and had both open and closed questions (see Annex 1). I let the farmers discuss the barriers for each of the practices in an open way, after which I asked specific questions when some factors were not mentioned as to cover all the elements mentioned in the theoretical framework.

Type of farmer	Amount of hectares	Amount of interviews	method used
Conventional farmer	>10	10	in person
Interested farmer	>10	10	in person
Agro-ecological farmer	>10	10	in person

Table 5: Initial division of interviewees

Informal discussion

After conducting interviews and analysing the results a focus group was organized together with AlVelAl to discuss the results. The focus group was named Agro-Café and was focused on three main regenerative practices: ground cover, compost, and hedges and borders. The main goal of this event was to extract possible interventions from the farmers themselves on how AlVelAl could support their transition. Unfortunately, the event was cancelled after which I invited the farmers I interviewed to lunch in one of the villages. This resulted in two informal discussions with each seven farmers on the interventions needed to implement the practices. The farmers (varying in farm scale) who were present at these discussions were from the village of Chirivel, in the middle of the AlVelAl region. The discussions on interventions were based on the perceptions of farmers and there were no discussions with other stakeholders like NGO's and government agencies. This choice was based on an earlier decision to focus only on farmers' perception and extend this to the interventions as well.

3.3 Operationalization of the variables

In this section the variables used are further specified. The operationalization of the dependent variable is discussed based on the conceptualization of agro-ecology, agro-governance and institutionalism in the literature and an analysis of the case at hand. The operationalization of the independent variables is discussed based on the framework of Runhaar et al. (2016) and institutional

and agro-governance literature. Although the data were measured in a qualitative way, by way of interviews, for own use the data was quantified to see relations between different elements and to make the amount of practices done clearly visible. This quantification is explained in chapter 3.3.2.

3.3.1 Dependent variable: transition to agro-ecological farming

The dependent variable of transitioning towards agro-ecological farming was measured by looking at four types of agro-ecological practices (water infrastructure, soil management, tree management and diversification: see chapter on theoretical framework). To make sure that farmers fitted the profile, the first part of the interview discussed the regenerative practices, how the farmers viewed them and if they implemented the practice. I interviewed nine farmers who are implemented all practices, eleven farmers who implemented half of the practices and ten farmers who only implemented a few practices (less than four).

3.3.2 Independent variables: factors

During the interviews farmers were asked about the obstacles and motivations for (not) doing certain practices and if they made the transition; what made them change their minds. This led to answers which were later translated into having a positive or negative influence on decision making and then given a '1' or a '-1' in the excel sheet (see Annex 2). Later in the interview farmers were asked specific questions related to one of the four factors (economic, social, informational, policy). After which the arguments were again given a positive or negative value on decision making and placed with one of the four factors in the excel sheet. If a factor was not at all mentioned in the interview, it was of low importance for the interviewee and as such of low importance to his/her decision-making process. To be sure this would be verified by asking about the other factors as well. Some arguments were given the value ++ or – because the farmer mentioned that this was by far the most important reason for doing something yes or no. The process of interviewing resulted in refining the questions and discarding some of the elements. The factors and the conditions that influence farmer decision-making have thus been analysed per practice, and more general, by looking at the interview as a whole. This method was used to be able to extract specific interventions for each practice, but also to use the other observations and arguments that not related to the practices per se. The results were put in an excel form and converted into a pivot table to easily visualize all the elements.

3.3.3 Independent variables: conditions

The framework of Runhaar et al. (2016) was used to find out which conditions were available for farmers to make the transition and if the barriers regarding a transition mainly originated from a lack of internal conditions (ability and motivation) or from external conditions (demand and legitimization).

Besides these four conditions, personalities of farmers, feedback loops and contextual factors also influence the decision-making, but these are discarded in this paper (Runhaar et al., 2016). The independent variable was measured by looking at the answers given during the interviews, consequently linking them to factors which then fitted in one of the four conditions. An example of this is that some farmers may have a lack of finances to buy compost which falls within the economic factor, and it is considered a negative influence (-) on the transition, influencing the ability of farmers to implement this practice.

3.3.4 Interventions

The interventions necessary (according to farmers) to transition to agro-ecological farming were determined using governance literature, and informal talks with farmers later in the process. Although many of the interventions could be found in the literature and linked to the specific factors influencing decision-making, a bottom up approach was used to see if the interventions mentioned in the literature also matched the ideas of farmers. This resulted in farmers discussing the most fitting interventions per practice.

4. Introduction to the case

The case study takes place in a country with one of the highest levels of land degradation in Europe. For reasons of feasibility, limited time and money resources, the area is limited to the south of Spain and more specifically Andalusia, a province in Spain with much too lose from degrading practices (García-Ruiz, 2010). The Spanish statistics website INE.ES has a census from 2009 on farm characteristics which is used as background information. The following paragraphs discuss the context of the case study. Elements like history, climate and farm characteristics are discussed.

The south of Spain has a typical Mediterranean climate. It knows two rain periods, high summer temperatures and low (zero degrees) winter temperatures. This in combination with an evapotranspiration that is five times higher than the annual rainfall results in an ever-drying region. A whole year of rain often falls within a few days causing major flash floods and washing away the top soil. Deforestation, grazing and burning of land have expanded desert-like areas. While it seems to be that the climate has changed much in the South of Spain, research suggests that the climate has been relatively stable for the past 6000 years and that water has always been a scarce resource. Traditionally this has been solved in the following ways: ‘’every source of irrigation is used, dry farming, dams, terraces and drought resistant crops’’ (Gilman, Thornes, & Wise, 2015).

Migration out of rural areas has increased pressure on the land and gave way for monocultural practices. Agriculture in the second half of the twentieth century was characterized by more powerful machinery, high investments in chemical inputs, switch to high yield seeds, and expansion of irrigation. While these changed saved the livelihoods of some, it destroyed many low-productivity farms. Profitability of machinery depended, and still depends, on the size of the farm, as do labour costs, and other investments. Young people eventually went to the city instead of following their parents (Collantes & Pinilla Navarro, 2011).

Photo 3: A young farmer starting with agro-ecological farming. His farm of 260 ha. only has 250mm of rain per year. On this picture he is busy taking samples of the soil to analyse what type of compost is needed. He is one of the few young people that wants to stay, but lack of possibilities is making him leave the area too.

To develop a sample of interviewees based on reality I looked at the farm characteristics in the region. The situation in Andalusia is one in which the 1 < 10 hectare farms only consist of 12% (around 700.000 hectare) of the total amount of farmed land, but of 68% of the farm businesses. The 10 < 30 hectare farms consist of 13% of the total amount of farmed land and is run by 15% of all farm businesses. The 30 > hectare farms consist of 74% of the farmed land but is run by only 10% of the farm businesses (Annex 3.1). This means that it is most useful to focus on the farmers with more than 10 hectares because they own 87% of the land and can thus make the biggest difference. Therefore, the farmers interviewed have more than >10 ha of land.

Farmers in Andalusia are not evenly represented with respect to age. Below the age of thirty there are almost no farmers (500 = 2%), and of those farmers only a few are women (5%). Between the age of 30 and 40 (10% of all farmers) there are still only few women working in this field, but it happens in small farm businesses. Most farmers reside in the group of 40 years and older (65+). This is 85% of the farm population. In this category women are more active, especially in the farms with 20 < 30 hectares (INE.ES).

The land in Andalusia is cultivated with olives, almonds, other fruit trees (mainly citrus) and other crops (Figure 5). The regions' focus lies on tree crops, which is also seen in the division of organic products.

Hereby the crops that are organically produced are mainly olives and fruit trees (Annex 3.2). To demarcate the research, the focus will be on farmers who cultivate tree crops (olive-, almond-, and fruit trees). These crops consist of 1.900.000 hectares of a total of 12.000.000 hectares (INE.ES). This demarcation also makes it possible to use the research in other areas of Spain in which farmers must deal with similar conditions. The results will be valuable for other Mediterranean areas with the same EU policy.

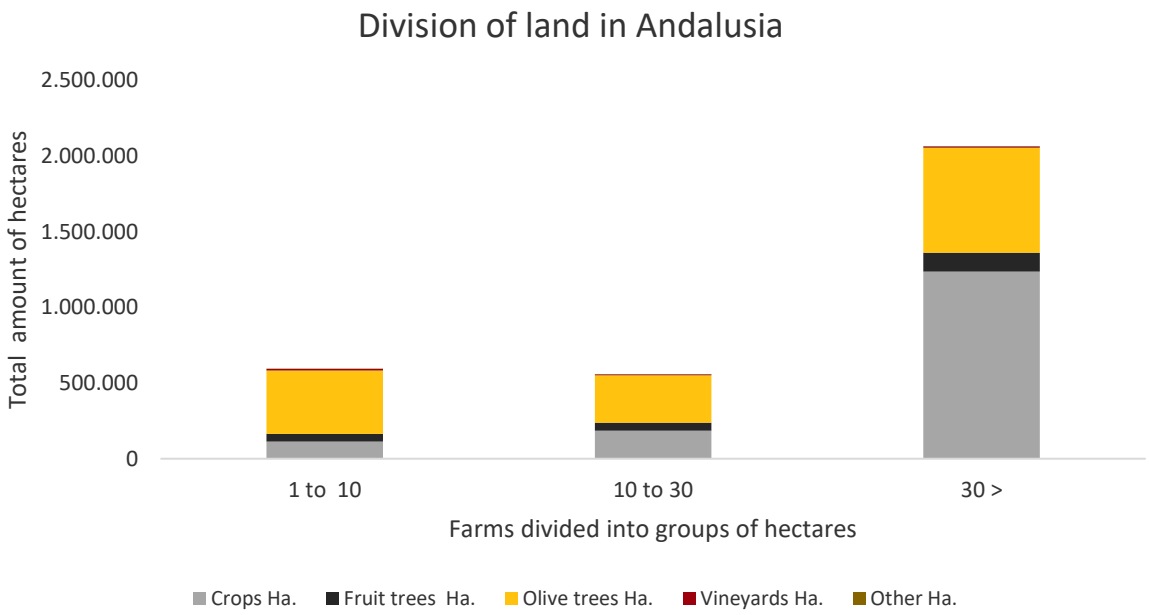

Figure 5: Division of crops in Andalusia

Andalusia has seen two agricultural “blooms" (first one general, second one only almonds). The first "bloom" was in the 80's when many land owners converted land towards agricultural practices; mainly olives and almonds because a new European subsidy was introduced (Hein, 2007). In this decade farmers could receive the subsidy per hectare of agricultural land with only few criteria resulting in the conversion of big areas of unsuitable land to agricultural land, like land on steep slopes etc. (Hugo et al., 2008).

Photo 4: This farmer came from Japan and started farming almond trees and hemp here. His goal is to farm totally agro-ecological but is struggling to make ends meet because it is hard to get financial support.

At the moment there is a new bloom for almonds in Spain. That has two reasons: 1) California has a low performance in the last couple of years, because of severe droughts and the colony collapse disorder in beehives (Rucker, Thurman, & Burgett, 2016). This has resulted in a reduction of the supply of almonds, which in turn resulted in a rise of almond price. Many land owners in Andalusia converted their land to almond production the last couple of years, so they could profit from this rising market value (this is a personal observation). 2) The cereals are performing bad lately and are barely profitable. This gives the land owners a second reason to convert the land to almond production (also personal observation).

One would expect that bigger farms use more agro-ecological practices, but according to the data this difference is not so great (Figure 6). Bigger farms (30> ha) more often use winter ground cover, minimal disturbance of the soil, and hedges or stone walls (sediment traps). Small farms more often use localized irrigation. The other practices mentioned on the statistics website INE.ES are not dependent on the size of the farm, although of course they have a bigger impact on bigger farms. Not all the agro-ecological practices are mentioned; all year-round ground cover, swales and dams, and diversity measures are not included. The data come from all farms in Andalusia and do not focus on tree crops. It is possible that the percentages for tree crops differ from those of all crops together.

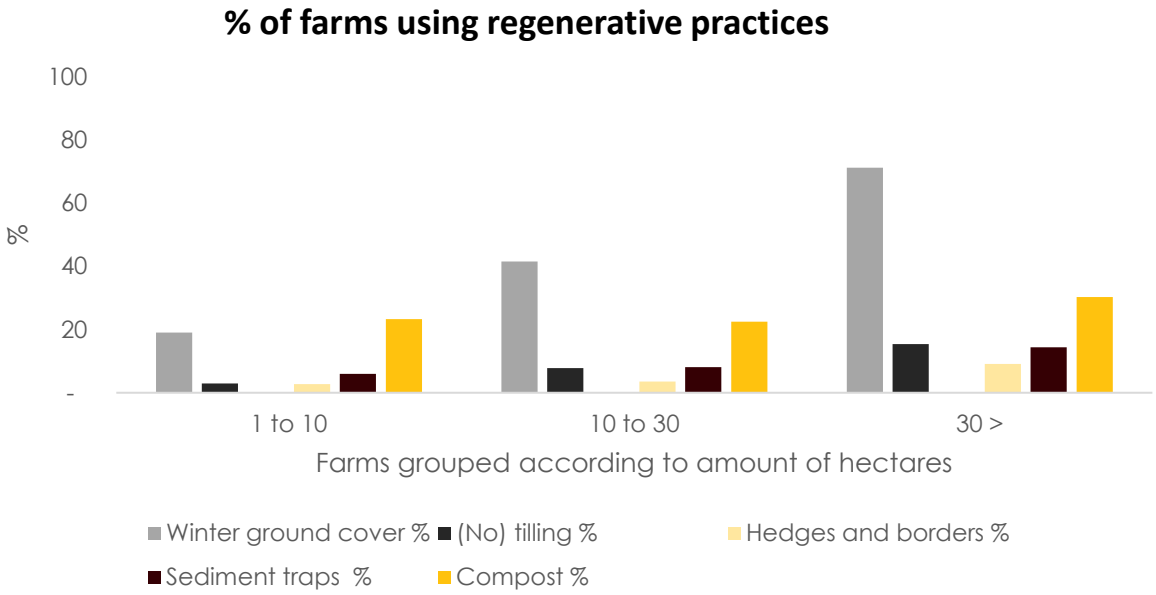

Figure 6: % of farmers using a certain regenerative practice according to the National Statistics Institute

There are only few farmers implementing regenerative practices (< 10%) and land degradation is becoming worse. Besides, 31,5 % of the people in Andalusia are unemployed ("Regional Statistics Illustrated," 2015). People move away because there are few opportunities in the degraded lands (Personal observation). Next to the lack of opportunities, there is a culture in which the farmers mistrust each other. Farmers regularly steal each other's equipment or cattle, which makes working together to restore land difficult (Preliminary interview, A. Guzman, 16-10-2016). Working together is often necessary as practices are implemented along borders of farms, besides, water is a shared resource.

Photo 5: This small-scale farmer has an agro-ecological mindset. He believes that intercropping is needed (he has ten different crops on his 12 hectare), does not till, has bees to make his own honey and pollinate his flowers: an ecosystem in equilibrium.

The sample chosen in this research is deemed representative according to the data of the National Statistics Institute of Spain although one must keep in mind that the interviews are held in a region that has had support from AlVelAl.

The issues apparent in this region are problematic on several levels. Andalusia loses income because of outmigration, loss of natural resources, greying of the population, decline in agricultural yields and more intense rain events. On a farmer level the degradation of land has a more personal effect. Seeing the lands degrade has intensified a feeling of powerlessness and hopelessness (personal observation). Farmers with degraded lands often have lower yield, resulting in a lower income and less possibilities. This way of farming results in a vicious cycle of degrading farm practices.

5. Results

In this section the empirical results of the research are discussed, consisting of the implementation of regenerative practices by farmers, the conditions and factors influencing the decision-making processes and the interventions needed. The implementation of practices is related to the availability of conditions which are discussed in more detail by interpreting them by means of the positive and negative scores on the factors. The arguments of the farmers were given a -1 for negative influence on transition and a +1 for having a positive influence. All the farmers were asked about their arguments for doing, or not doing a certain type of practice. Some farmers did not have arguments for some practices and many arguments for (not) doing others. This is visible in the graphs' vertical axe as 'times mentioned'. Each practice is discussed individually after which some general observations are discussed. For more detailed information on the factors influencing the implementation of each practice see Annex 4.

From the data it became visible that most farmers apply some regenerative practices, even though not always on purpose (Table 6). Sediment traps, swales and key line cropping, no tilling and integrated use of animals are the practices least used by farmers. Ground cover is quite often used but this is only winter cover. All year-round cover was only implemented by one farmer. Manure, diversity of crops, pollination, and integrated pest-management are most often mentioned. There are some practices noticeable on the farm, like hedges and borders and integrated pest management, that have never been deliberately put in place. Some interviewees said that natural areas and hedges and borders on the farm housed ladybirds who in turn ate the lice. Nevertheless, they did not actively plant trees or bushes which attract these insects.

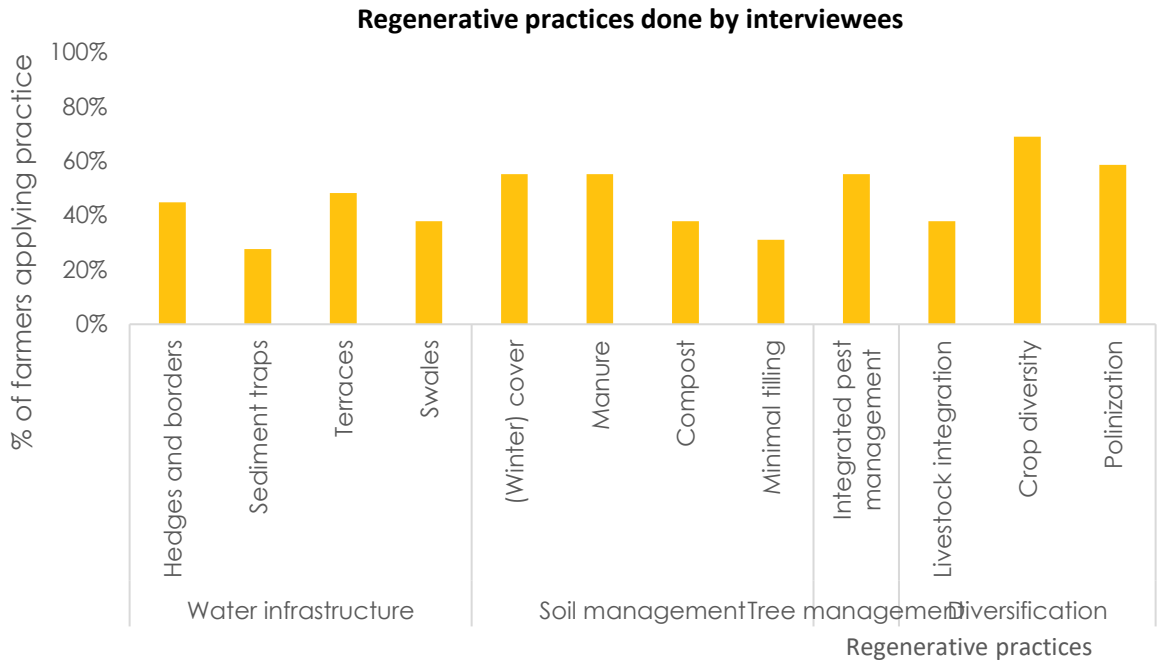

Figure 7: Regenerative practices done by the 30 interviewees, categorized according to the theoretical framework.

Irrigation (meaning drip irrigation), sustainable phytosanitary management and mosaic landscaping were mentioned in the theoretical framework but have not been discussed by farmers. None of the thirty farmers irrigated their tree crops for example. The first few interviews also discussed the practices mosaic landscaping and phytosanitary management but, probably because of the language barrier, these were misunderstood and therefore these practices were also taken out of the analysis. The following sections discuss the regenerative practices and their conditions one by one.

5.1 Conditions and factors influencing specific practices

5.1.1 Compost

This practice is meant to increase the biodiversity and fertility of the soils; it serves as a natural fertilizer and fuels plant growth. It can be especially useful in nutrient poor soils, like the ones in the AlVelAl region. The use of chemical fertilizer was not discussed in the interviews. Ten of the thirty interviewees have implemented compost, but many do not apply it on all their plots, because of the costs of buying compost are high, and the availability of finances is low (see Figure 8). Nevertheless, it is known by more than half of the farmers that the benefits exceed the costs and that it positively influences the farm ecosystem and their yields, which increases their motivation.

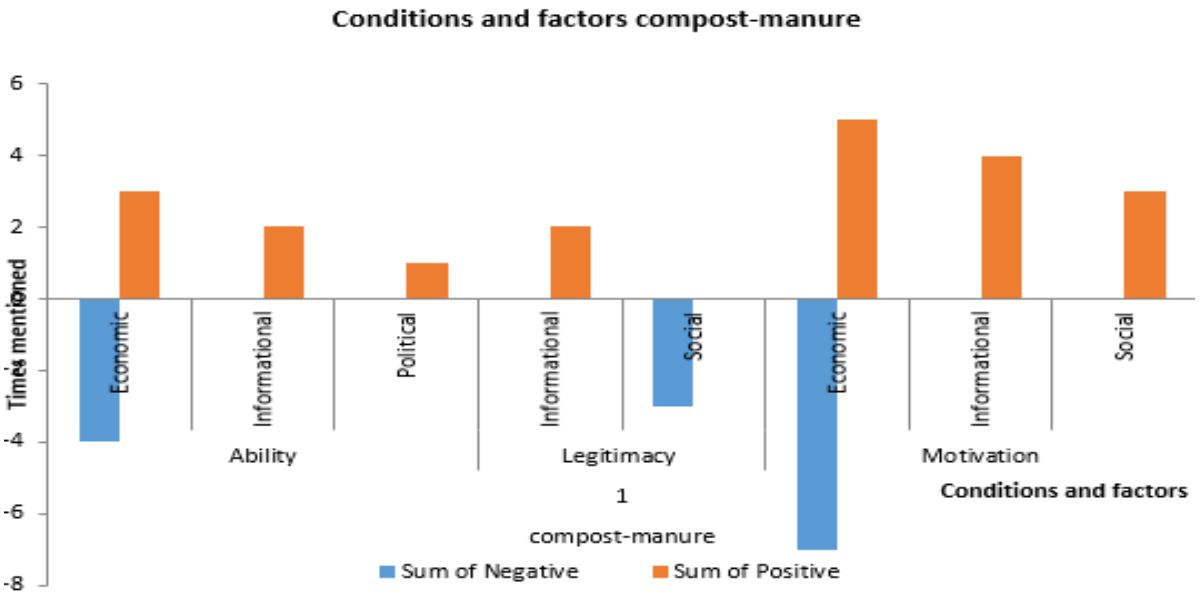

Figure 8: Results of factors influencing use of compost. Results based on 30 interviews.

Compost is more often used by large scale farmers and not so much by small farmers because it is expensive. Three large scale farmers among the interviewees have set up their own composting company, hereby lowering the costs. Manure on the other hand is a more affordable alternative, but it is not as effective as compost. Together with integrated livestock this could become more interesting, but that also brings about some difficulties. Unsustainable management of livestock can lead to overgrazing, which results in further degradation of the land. Also, the industrialisation of agriculture has resulted in more tilling, thereby reducing vegetation cover and fodder for livestock.

5.1.2 Ground cover

Ground cover decreases erosion and increases the uptake of water in the soil, it also increases soil life and is seen as one of the most important practices in stopping land degradation. Half of the farms have winter ground cover, but only one farmer applies it all year round. The obstacles for implementing ground cover are numerous. Not only is ground cover not legitimized by the community, farmers often do not have the ability to implement because of a lack of technical skills and information on how to implement correctly. The strong lack of community support demotivates farmers to even try ground cover. When farmers understand the importance, and know how to do it, in other words they are enabled, it is much more likely that they implement ground cover. Information about the benefits of ground cover for the farm ecosystem has a positive influence on farmers' ability and motivation. In this region, the demand for ground cover is absent as most governmental agencies and cooperatives do not believe that it is possible here with so little rain. This, and the indirect effect of adjacent policies has a negative effect on the legitimacy of implementing ground cover.

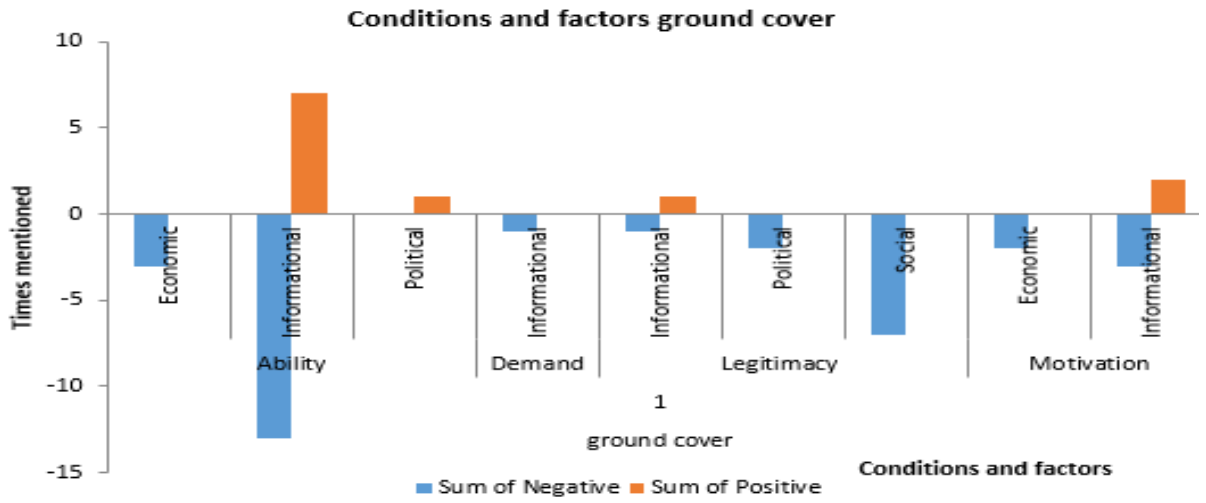

Figure 9: Results of factors influencing use of ground cover. Results based on 30 interviews with farmers

5.1.3 Hedges and borders

Not all farmers know the economic and ecological benefits of this practice. Hedges and borders can serve as an erosion barrier, a home for pollinators, wildlife and insects. By some farmers hedges and borders are considered as 'not clean' as they house insects and plagues. The social construct in this area is that a farmer is only a good farmer if his land is 'clean'. This does not enable or legitimize them to implement it. On the other hand, motivation increases when farmers have information and have seen that it works. As some farmers said; because of hedges and borders they never spray pesticide anymore as these borders provide a function of natural pest control. There is a positive push and demand from government and NGO's to implement this practice, not only from a pest control perspective but they can also function as natural corridors for wildlife, biodiversity and pollination.

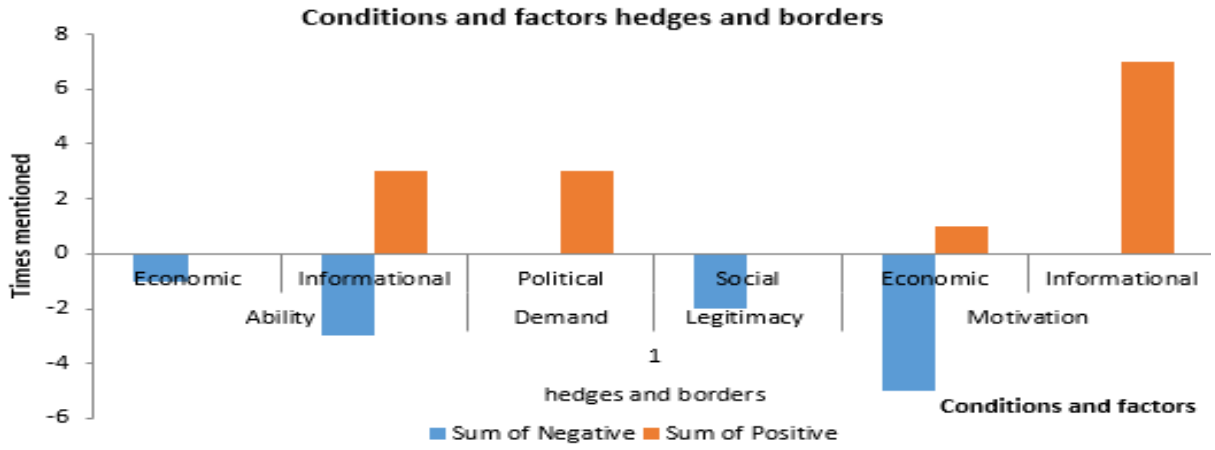

Figure 10: Results of factors influencing use of hedges and borders. Results based on 30 interviews with farmers

Information clearly influences both motivation and ability positively. Hedges and borders are easily implemented, as, in their simplest form, they only require leaving place for natural vegetation to grow. Making more conscious use of this practice, farmers can plant hedges and borders keeping in mind natural pest management and plant hedges and borders that can house insects, can increase biodiversity and are a home for pollinators (see Annex 4.5 and 4.7).

I have come to see pollination, integrated pest management, biodiversity and hedges and borders as practices that are all linked to each other and could be implemented as one. Except for pollination, the other three practices are not intentionally applied but also not negatively viewed.

5.1.4 Integrated livestock

Farmers are generally not motivated anymore to integrate livestock on their farms. This lack of motivation is influenced by economic obstacles such as high costs and low benefits. Besides that, the bureaucracy of applying for permits is such a long and dreadful process that the time and energy spent is often demotivating.

There is a very difficult balance between the carrying capacity of livestock (often sheep) on the land, and the amount necessary to break even. As most lands do not have ground cover, it is difficult to find food and overgrazing on natural areas is the result. In the case of integrating livestock, none of the conditions are available for implementing this practice although information seems to have a positive influence. Another major issue is that most farmers do not trust the shepherds to take good care of their lands and trees. The 'bad' management by shepherds has often led to damaged tree crops and the destroying of valuable plants (see Annex 4.3). Figure 8 shows that demand has not been mentioned by the interviewees.

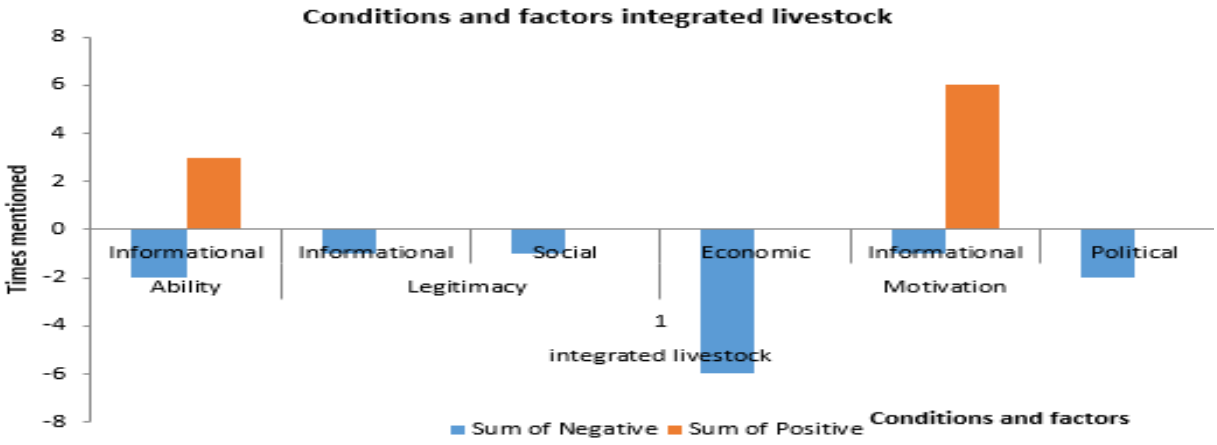

Figure 11: Results of factors influencing use of integrated livestock. Results based on 30 interviews with farmers

5.1.5 Integrated pest management

For the implementation of integrated pest management two conditions are present; ability and motivation. Legitimacy is lacking and demand is not mentioned. Information about the benefits and a type of farming style (often organic) enable farmers to implement this practice. Understanding the farm ecosystem positively influences the motivation of farmers. Ten farmers mentioned the word 'equilibrium' related to this question, suggesting that the understanding of the system and the natural management of pests lead to a farm ecosystem in equilibrium.

Demand and legitimacy are not mentioned and are therefore considered absent. Personal observations suggest that integrated pest management is still scarcely researched in the almond sector and farmers want to have proof of its feasibility. Besides, although there is some demand from governments and NGO's to increase biodiversity and use natural pest control, how this could be implemented and what this could look like is not clear.

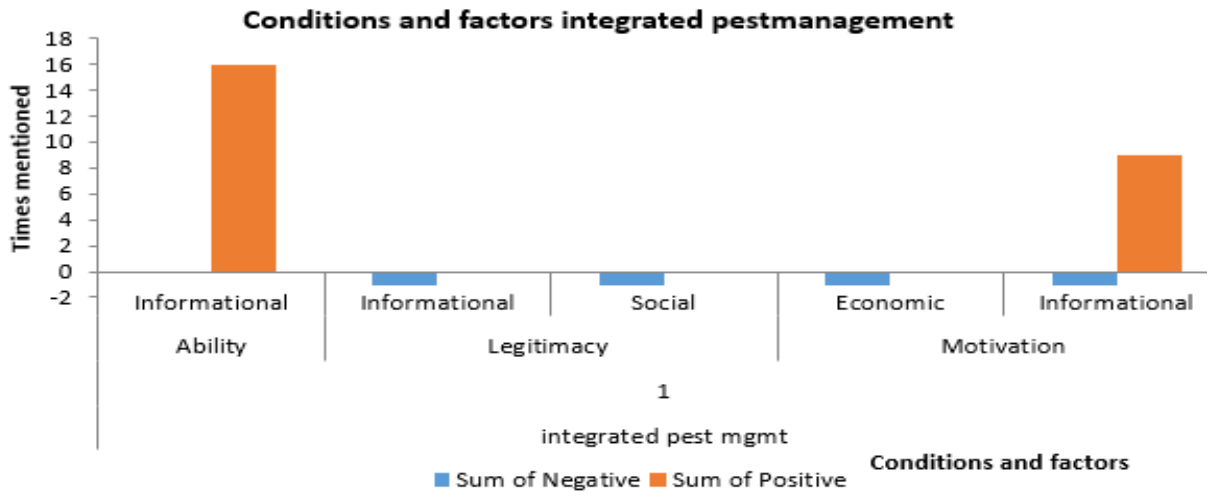

Figure 12: Results of factors influencing use of integrated pest management. Results based on 30 interviews with farmers

5.1.6 No tilling

There is little demand and no legitimacy for no/minimal tilling. AlVelAl and Commonland request farmers to apply no/minimal tilling but this is not well received by most of the farmers as they see this as a request from people who do not understand how farming in this region works. Besides, the community does not support the implementation of ground cover at all, farmers who apply it are considered as lazy, dirty and not suitable to take care of their land. Farmers often mention that no tilling might work, but not in their farm, because it is necessary to increase the water uptake of the soil. Farmers who have made the transition toward no tilling say that it takes at least four years and

needs to be carefully planned combined with green cover. The people who have the knowledge about the benefits for the ecosystem are motivated to put it into use, but for most people motivation lacks, especially because they lack this type of information. The same goes for ability, farmers who have the knowledge and the skills are able to do it, but most farmers do not have this and are not part of a community of practice which can support them.

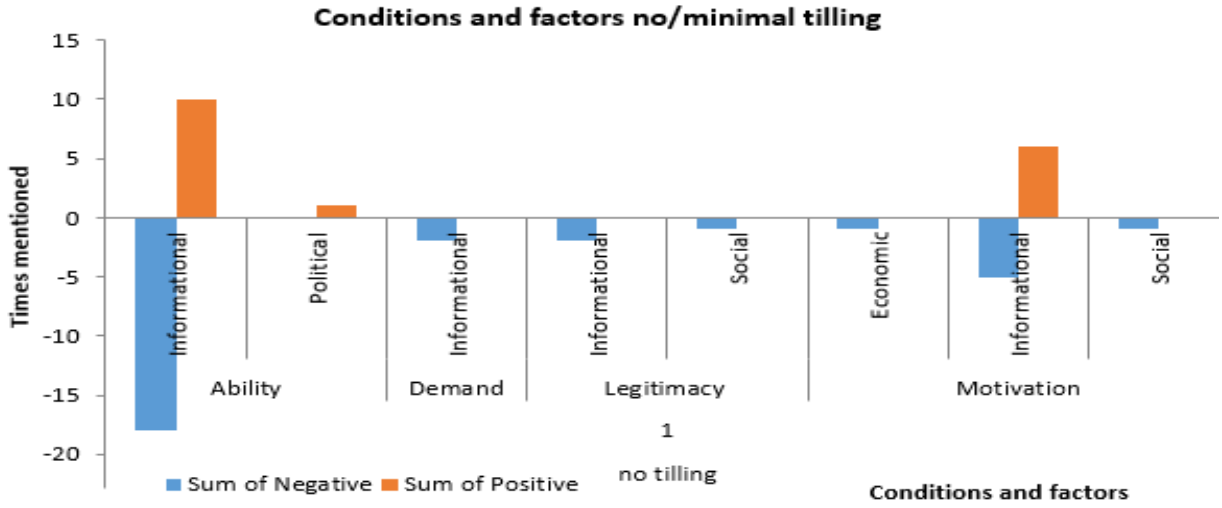

Figure 13: Results of factors influencing use of no tilling. Results based on 30 interviews with farmers

No/minimal tilling in combination with ground cover (S. Gliessman, 2016; Wezel et al., 2014a) are the practices that are most beneficial to the degraded ecosystems in the South of Spain. But, these are also the practices that farmers find most difficult to accept and of which there are only very few best-case practices visible, at least in the almond sector. The lack of good examples of how to implement these practices has much to do with the complexity and interdependence of the two practices. No/minimum tilling can only work in combination with ground cover; otherwise high evapotranspiration rate and high run-off degrades the land even faster than with tillage (see Annex 4.4 and 4.8).

5.1.7 Sediment traps

Sediment traps have only been done by a few farmers, because the practice is quite new and there is little information available. The farmers whom I explained this practice to, where motivated to do it because it is relatively cheap, there are quick results and there are no major social barriers. Nevertheless, the practice demand by government, business and NGO's is still low.

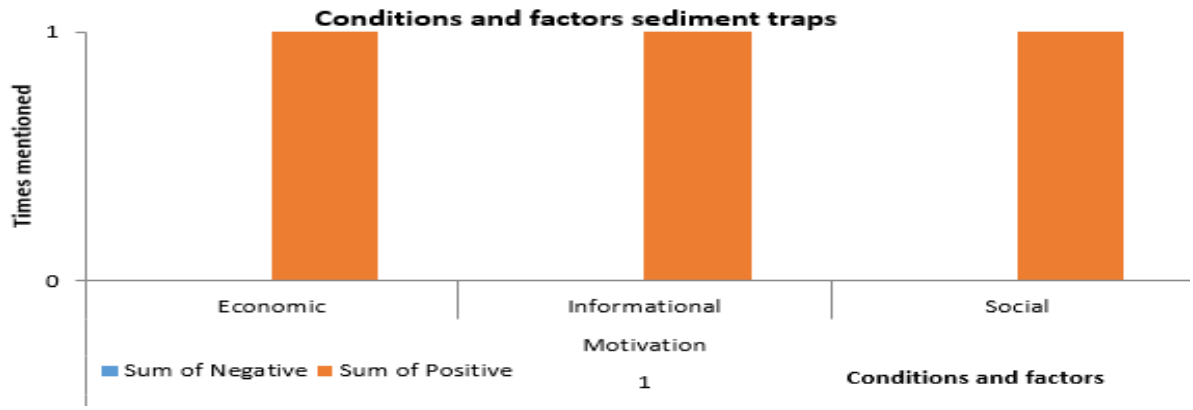

Figure 14: Results of factors influencing use of sediment traps. Results based on 30 interviews with farmers

From personal observation, it became apparent that many farmers are not actively implementing water infrastructure because this does not directly result in higher production, as chemical products for example do. Nevertheless, some water-infrastructure practices are quite easy and relatively cheap to implement and can have high benefits, thus influencing motivation positively. Sediment traps for example, cost between €50, - and €200, - per trap and around ten traps can be implemented per day. Besides, they have short term visible benefits; per rain-event the trap holds the sediments and slows down the rain, it also gives the soil more time to absorb the water (see annex 4.9).

Photo 6: Implementing one of the regenerative practices: sediment traps

5.1.8 Swales-Keyline

Farmers are not motivated or legitimized to implement this practice, but there is demand and they are enabled by politics. The lack of motivation is mainly influenced by economic factors; meaning that it is expensive to implement this practice; farmers need someone to make the design and rent the machinery to do it. The implementation of this practice also influences the primary processes of farmers; as the trees are not planted in a straight line, it costs more time to harvest, till etc. It is not as fast and easy as a conventional plot design. Also, many farmers do not see the benefits of such a system. As this is a practice that is seen as innovative, there is only a small community of farmers advocating for it, decreasing its legitimacy. Farmers are generally able to do this practice if someone, a consultant, helps them with the design. It is easier to implement when farmers are planting their trees. Economic factors negatively influence the ability and motivation of implementing this practice as there is an investment needed and the economic costs are (in the beginning) higher than the benefits. Political factors positively influence the ability of farmers as they can receive a subsidy and other support from the government.

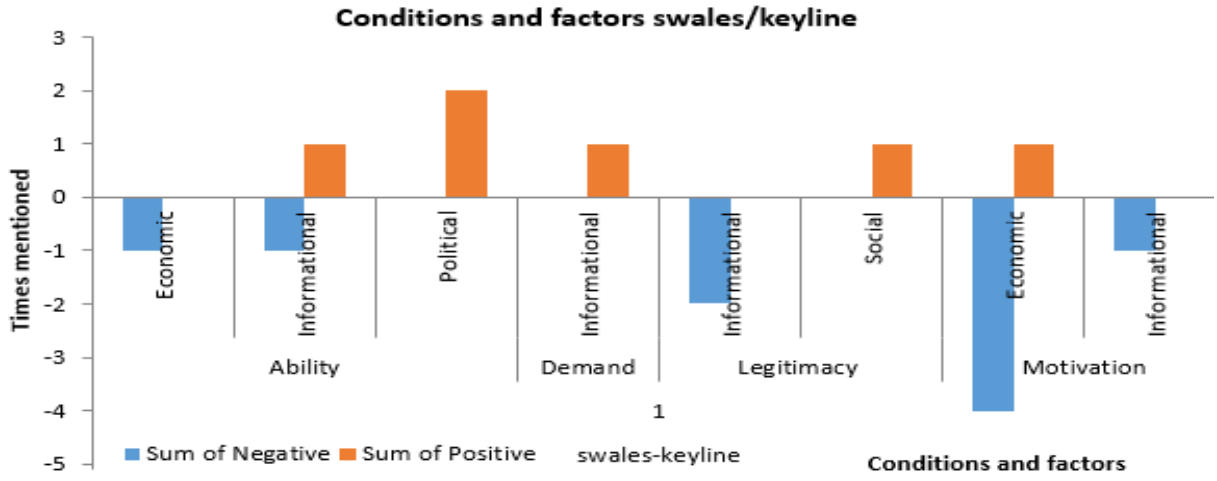

Figure 15: Results of factors influencing use of swales or Keyline planting. Results based on 30 interviews with farmers

Swales are applied by using certain technologies and machinery that only two farmers in the region have in their possession. The application of swales is hold back by a lack of information and economic possibilities, which in turn influences the motivation and legitimation (see Annex 4.10).

Photo 7: Implementing one of the regenerative practices: swales.

Photo 8: The same swale one day after a rain event of 5 cm, sediments and moisture visible

5.1.9 Terraces

Terraces were not discussed extensively in the interviews. They are not legitimized within the community, but seen as a practice from the past (social factor) which is old fashioned. Besides, governmental agencies, businesses and NGO's do not demand from farmers to keep or make terraces. In the monocultural system dams and terraces are not efficient as these plots are not easily accessible with big tractors and other machinery. They are time consuming as they need to be constantly checked and repaired. This does not fit the idea of farmers that it should be simple and preferably without having to look after it too much. The social construct of terraces has influenced the motivation of

farmers also negatively (see Annex 4.11). Nevertheless, the information about benefits positively influences farmers as well as knowledge on how to implement this practice.

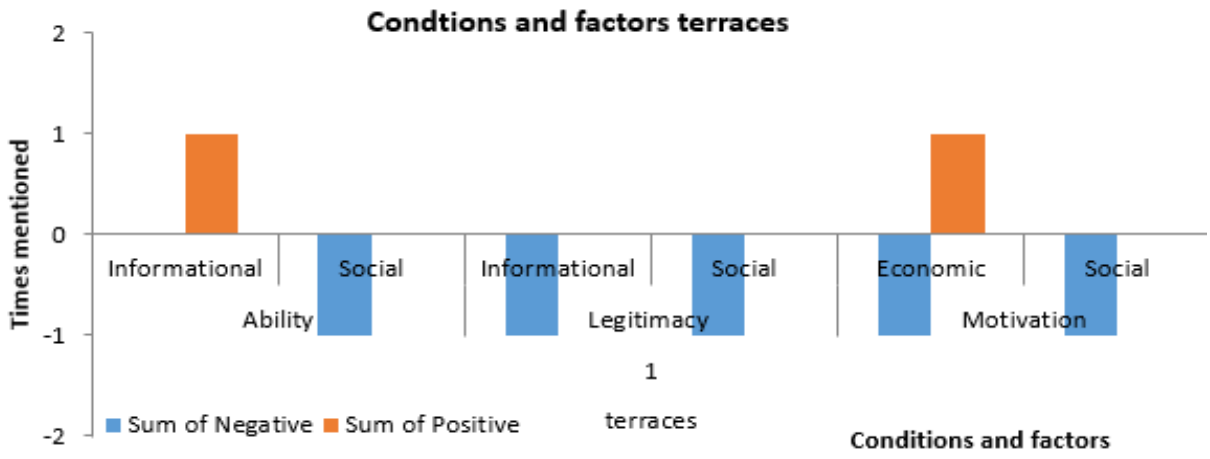

Figure 16: Results of factors influencing use of terraces. Results based on 30 interviews with farmers

Besides considering each regenerative practice individually, I also examined the results of the interviews as a whole and looked at which factors are the most important in the conversations. In the thirty interviews the conditions ability and motivation have been most often mentioned (see Annex 4.1) and amongst the factors there was a clear focus on informational factors (see Annex 4.2).

Having information and a strong community are the most important factors influencing farmer motivation. This connects well to the literature in which knowledge and community are also mentioned as key factors (Carlisle, 2016; Isgren, 2016; Lalani et al., 2016). Economic factors form a barrier even though farms might be motivated to change. This mainly pertains to the high investments and lack of finances required to implement certain practices. This fits with the statements made by Clay et al. (1998) who state that sufficient financial well-being has a positive effect on implementation (Clay et al., 1998).

Being legitimized to transition to agro-ecological farming was influenced mainly by the cultural setting and peer pressure in the community. Working together in a cooperative in turn positively influenced the transition. Working together has been mentioned in the literature by Pretty (2001) and Nowak (1987) as playing a vital role. Peer pressure though, has not been studied much related to farmer decision-making.

Photo 9: One farmer said he was very sustainable; when I went to see his farm, I saw he mulched all the plastic through the soil.

Even though much has been written about what is necessary to restore the land, this is easier said than done. Besides that some practices are not considered by farmers as viable options (no tilling, ground cover all year around), the complexity and the infinite number of variables that need to be taken into account make a one-size fits all solution impossible. It is just not efficient to depend on natural ecosystem functions (Isgren, 2016).

Photo 10: Implementing one of the regenerative practices: ground cover.

Linking the results back to the framework of Runhaar et al. (2016) in which the vertical axe is divided into internal conditions (motivation and ability) and external conditions (demand and legitimation), it becomes visible that the interviewees gave more importance to internal conditions than to external

conditions. Reasons for the interviewees to transition are not based on commanding farmers to change, they are more based on voluntary commitment.

5.2 Meeting the obstacles for transition

In this chapter the interventions, or possible courses of action, are discussed and related back to the literature. This pertains to the possible interventions taken by stakeholders (business, NGO, government) in order to steer on the barriers mentioned by farmers. During informal talks farmers connected the most fitting interventions to specific practices. The plan was to organize a focus group with the farmers in order to give them the floor to discuss what they need to implement certain practices. Unfortunately, the event was postponed and therefore two informal talks with seven farmers during lunches had to suffice. This chapter is divided into recommendations per practice and general suggestions. These recommendations can be implemented by NGO's, government, agrarian organizations, or businesses.

5.2.1 Compost

Two interventions can help to transition towards the use of compost. The first is the accessibility towards information about compost; its benefits to the ecosystem and economic benefits. Besides that, information and skills are needed for the transition and farmers need to know where to buy compost and/or how to make it. It can be beneficial for farmers to make their own compost, but this is true only for large scale farms. Farmers often do not know that the yields can increase up to 40% in the almond and olive sector, which makes the use of compost worth the investment. Because most farmers lack this information they think that the costs are disproportionate and not worth the loan or investment. This information can be given by NGO's (like AlVelAl) or local cooperatives (Ferwerda, 2015). The Almendrehesa, the almond business set up by AlVelAl, can make the use of compost a minimum requirement for farmers wanting to sell their almonds through that channel under a premium (Hart et al. 2016). These interventions are backed up by Knowler (2007), Meyer (2009) and Uri (1998) who say that providing information and technical assistance are key to enabling a transition.

5.2.2 Ground cover and no tilling

With ground cover and no tilling the situation is more complex, as only very few farmers believe this can work, they want to see proof on farms that are similar to theirs. Ground cover is the riskiest of all regenerative practices as wrong implementation can lead to tree crops dying. There is only one successful example in the whole AlVelAl territory. Research is needed on how to implement it correctly which can be done by supporting demo farms in the area and showing that ground cover is actually

feasible. In this case, government and the EU subsidy system could also play a role, as they can cover any losses or give grants for the implementation. The Almendrehesa could make a start with no tilling and ground cover as a requirement for at least six months per year including minimum tilling of once a year in spring. If farmers then see that this does not greatly influence their yields or plant growth the implementation of ground cover can be further developed. According to the literature technical assistance (Uri, 1998), voluntary instruments (Borgström et al., 2016) and risk-coping mechanisms (Kassam et al., 2012) can support farmers in this process.

5.2.3 Hedges and borders

There are two options regarding hedges and borders, the first one is to plant them, which requires a lot of labour and thus high costs. The second option is to not mow and till certain areas of the farm and let them grow naturally, which does not cost anything in planting. The difficulty with hedges and borders is that the benefits are only visible on the long term and the costs in the beginning can be high. According to farmers the most valuable intervention could be a business plan that has been developed by AlVelAl. This plan discusses a cooperation between AlVelAl and volunteers of an ecosystem restoration camp in the region. AlVelAl can give information on the benefits and how to implement the hedges and borders in each farm, the farmer can buy plants and the volunteers can plant them for free. In that case the monetary obstacle is removed. This intervention is also elaborated upon by Pannel (1999) who sees extra labour as the support needed for the implementation of hedges and borders. Almendrehesa, the company selling regenerative products, can put the implementation of this practice as a requirement. Besides, there are subsidies (CAP) available for the implementation of hedges and borders which, if known, can positively influence the transition. The subsidies (K. Turner et al., 2016) are in top down interventions, while the development of new business models (Ferwerda, 2015) are considered self-governance.

5.2.4 Livestock integration

When it comes to the integration of livestock on farms, there are two things that need to be considered which make implementation difficult and its benefits even questionable. Implementation of livestock depends on the age of the tree crops. It is not feasible for farmers to have animals grazing on plots with trees that are younger than four years old because the trees often die. Besides, many shepherds do not have knowledge on sustainable grazing. Farmers reject the integration of livestock because it is very complex and it is hard to break even. Some interventions that farmers consider feasible are the education of shepherds (Uri, 1998) and financial support from the CAP (K. Turner et al., 2016), the

government or NGO's, but most of all research is needed on how to implement such a practice without it working contradictory to restoration.

5.2.5 Integrated pest management

Integrated pest management is a practice that is the result of all the other regenerative practices. If the other practices are done well, a system in equilibrium is the result. NGO's and other institutes can give information about the benefits of doing certain practices like hedges and borders that can have as a consequence that plagues are naturally diminished. It was mentioned by farmers that integrated pest management is best marketed by showing its benefits on farms. Farmers then discuss the practice or ask around. A community of practitioners influences the ability and legitimacy of doing this practice (Borgström et al., 2016; Runhaar et al., 2016).

5.2.6 Sediment traps

The obstacle to implement sediment traps is that farmers think it is expensive and they do not have the knowledge on where to implement these traps on their farms. AlVelAl can give information on the costs and benefits of implementation and provide technical assistance on where to implement them. This is supported in the literature by Meyer (2009) and Uri (1998). Farmers mention that AlVelAl and agricultural cooperatives can also provide help with renting out the necessary machinery as is also mentioned by Erenstein et al. (2012).

5.2.7 Swales and Keyline

For swales and Keyline planting the situation is similar. Swales are a more modern, and better option than terraces. They are easier made, cheaper and plots are reachable with machinery. AlVelAl, and other NGO's, have more chance focussing on swales than on terraces. They can provide technical assistance for designing the plots and connect with people who can implement them. For farmers it is important to see examples of how this practice works, therefore farmers suggest that the implementation of these swales should be financially supported on several farms. The implementation of this practice can also be supported by grants and subsidies of the EU as voluntary instruments. Providing machinery (Erenstein et al., 2012), subsidies and grants (Ferwerda, 2015; K. Turner et al., 2016) and technical assistance (Uri, 1998) are interventions which can support the implementation of swales and Keyline planting.

5.3 General observations

Besides specific results, there are some general outcomes that are derived from the interviews (see Annexes 4.1, 4.2). This chapter has been developed because statements were made during the interviews which were not linked to any practice per se, but were more stated as general tendencies and are thus considered important for the broader perspective.

The ability of farmers to transition to regenerative practices was foremost influenced by skills and information about the benefits. This suggests that NGO's and farmer cooperatives can organize courses and workshops in order to develop these skills. These workshops do not only enable learning; they also create communities of farmers which enables more a more supportive community. Enabling farmers can also happen more top down with large scale educational programs.

The lack of financial possibilities negatively influences farmers. There is a lack of consultants who know about regenerative agriculture and how to get financial aid, both in cooperatives as well as in the government. Although there are subsidies available for these practices, they are often not known and difficult to acquire. This could be changed by developing a network of consultants, cooperatives, and government officials who have this knowledge and can help acquire the much-needed funding. Although not mentioned in the framework, risk taking was mentioned seven times as playing an important role in the decision-making. Many farmers are financially just not able to take any risks because they are already in debt.

Twenty respondents stated that they feel that they cannot change anything about the worsening climate and the decrease in water availability. The lack of information on the possibilities to change this situation and being afraid to change negatively influencing farmers' motivation. A feeling of responsibility for future generations has changed the minds of some farmers in this case study, they saw an increased amount of health issues in their family, and saw that their lands contained less life each year. This was a reason for farmers to increase their knowledge of the farm ecosystem and made some careful changes on their farms. This could be supported by AlVelAl, and is already supported, by creating awareness and sharing knowledge about the benefits of restoring the land, not only for future generations but also for the health of people around.

Political factors were barely mentioned, related to motivation. That is not so strange if one considers the lack of fair treatment from governmental agencies. Many farmers do not consider politics because corruption changes the rules every time.

The motivation of farmers generally decreases when there are high costs, and thus high risks involved. The willingness of farmers to try out and implement practices often coincide with the availability of labour on the farm. The implementation of the practices is often labour intensive, influencing the

primary processes on the farm. Offering extra labour (free) increases the probability of farmers trying out these practices. Other options are risk coping mechanisms, like monetary support in the case of any losses in yield the first years of transition.

The legitimation of doing regenerative practices almost totally depends on social factors. Working together in an association like AlVelAl, increases the legitimation for doing regenerative practices. As they are supporting innovativeness and new business ideas they hereby give space to farmers to develop new ways of living on their lands. Unfortunately, the general cultural setting in the south of Spain is one in which trying new things is often not received well, communities are mainly focussed around conventional farming and not around regenerative farming, and peer pressure gives farmers little space to try new things. Voluntary instruments like developing a peer to peer certification system, or financially rewarding the implementation of practices could positively incentivise farmers to transition.

The demand to do regenerative practices is low, and it is mainly influenced by politics. The policy of the EU to support organic farmers has made a big change in the region the last five years, with many almonds farmers now converted to organic farming. The market for organic products is still growing, but the demand often does not reach the south of Spain. The Almendrehesa, which sells regenerative almonds in Europe, has requested of farmers that they implement regenerative practices in order to sell their almonds through this company. This has incentivized farmers to change their practices and could be marketed on a bigger scale and with other products as well. If it becomes more normal for businesses to have clear rules and regulations about the production of food without degrading the land, this can fasten the transition process.

6. Discussion

This chapter discusses the limitations of the research, the theoretical implications, the additions to the literature and ideas for further research.

6.1 Limitations

There are some limitations to this research which have to do with the reliability and validity of the interviews. I will start with remarks concerning the use of the twelve regenerative practices, after which limitations of the interviews are discussed.

The framework with twelve regenerative practices used in this research has functioned quite well as a basis for measuring the transition towards agro-ecological farming. Nevertheless, the exclusion of some practices from farms did not mean that farmers were not regenerative, this could have to do with geographic characteristics of their farm and was not necessarily a sign of lack of motivation. For example, some farmers were situated on flat land and thus did not need swales or Keyline planting. Thus, the amount of regenerative practices done by farmers is a questionable measurement for being an agro-ecological farmer. In this thesis, the focus was more on a transition towards agro-ecological farming and not as much on the amount of practices done.

The initial division of farmers in three groups (agro-ecological farmers, interested in agro-ecology, conventional farmers) was deemed unsuitable after reviewing the data. One farmer for example said he did not do ground cover, hedges and borders, pollinators, diversification of crops. But, when we walked over his plots, all these practices were present. There are also farmers who think that they are sustainable but are not; they mix the plastics used to prevent weeds from growing through the soil after the harvest while others actively implement and believe in agro-ecological farming. Besides, there are farmers who talk about doing regenerative practices, but in the end are not that active in implementing them. To adjust for this, I included the personal observations made on the farm and asked the respondents about the presence of the practices and why they did, or did not implement them.

During the interviews some farmers did not understand the word sustainable or ecological the way I had in mind. Reponses to the question ‘what does sustainable farming mean for you’ were focused on social and cultural sustainability rather than ecological sustainability. Other farmers spoke about problems related to water shortages, lack of finances, and an emptying region. Although not the intention of the question, this did give an idea of how sustainability is (not) embedded in the minds of people.

The interviewees are considered representative for the rest of the South of Spain as they are mirrored after the data found on the farmer population in Andalusia. Nevertheless, the three year presence of AlVelAl has probably influenced the information they received and possibly their receptiveness towards regenerative practices. The AlVelAl region too, is considered representative for the rest of the South of Spain which has similar geographical characteristics.

Considering the discussion on interventions, this could have been more elaborate by also including government officials and other stakeholders. Farmers often do not have the complete picture with regard to all the interests and stakeholders involved and the interventions they mention are quite general.

6.2 Theoretical implications

The framework of Runhaar et al. (2016) which has been used and updated to fit the research questions at hand, was deemed useful to extract the factors influencing the decision-making processes of farmers. The use of visuals based on quantified data was valuable in analysing which factors were of importance. The following paragraphs discuss the contribution to the theory and some rival explanations.

The results of the interviews matched the framework of Runhaar. All the arguments fitted in one of the four conditions. The focus of the arguments was on motivation and ability which are both considered internal conditions. External conditions like legitimacy and demand were mentioned less often. A reason could be that I only interviewed farmers and no other stakeholders like government officials, or businesses. Farmers often leave the selling of their crops to cooperatives and traders and the subsidies to consultants. A follow up research can include other stakeholders and discuss the factors and interventions as mentioned by farmers in order to get a more complete overview of the possibilities.

Personal observations suggest that demand is quite an important factor, but demand has not triggered farmers to transition yet. This observation is derived from the information on the subsidy for organic farming, which showed that an increase in demand also increased the implementation of organic agriculture. Another observation was made on the BIOFACH Trade Fair on Organic Food in Nuremberg, Germany (14-17 Feb 2017) which showed that there is an increased interest in regenerative and sustainably produced food. Although demand is increasing, this is not visible for farmers as they do not receive significant higher prices for their products and thus do not feel that the market is growing.

There are several theoretical implications concerning the factors: education was of little importance in farmer decision-making, which corresponds with the argument made by Nave (Nave et al., 2013) mentioned in the theoretical framework. The importance of rules and regulations, as mentioned by Carlisle (2016), has not become clear during the research as some farmers saw it as important and others not. Communication was seen as a main factor by Carlisle (2016) and Novak (2008) which corresponds with the arguments given by farmers (Carlisle, 2016; Novak, Joseph D., Canas, 2008).

Religious factors, which were included in the framework, were not mentioned once by farmers. Which is strange because religion is deeply embedded in the culture of the South of Spain. Also, corruption has not been mentioned often. It is not clear if this is because farmers do not find this important or because of the way of questioning.

6.3 Further research

Some regenerative practices like livestock integration, vegetation cover and no-tilling were not considered regenerative by farmers but were seen as destroying the land. The lack of successful examples (in the almond sector) shows that more research is needed before these practices can be promoted. This research can specifically focus on the implementation process; How long does this take, what crops are favourable, which actions need to be taken at which time etc.

Future research is needed in the area to test the interventions mentioned. Although farmers mention some of the interventions as being important, their workings have not been proven yet. This could be tested through game theory or a participative study.

7. Conclusion

Two main questions are answered in this research:

What are the factors that influence the decision-making of farmers to transition to agro-ecological farming in the region of Andalusia?

How can these factors in turn be influenced by stakeholders?

Although some of the farmers state that they are positive towards stopping land degradation and desertification, there seem to be many barriers that prevent them from transitioning. In terms of the framework that was employed in this study and that identifies four conditions for farmers to switch to a more sustainable form of agriculture (Runhaar et al., 2016), it means that only the condition of 'motivation' is currently present but not the conditions of 'ability', 'demand' and 'legitimacy'. This was measured by giving the arguments a '+' (positive influence on transition) or a '– '(negative influence on transition) and consequently categorizing the arguments in the four factors and linking them to the conditions. The quantitative analysis of the data bolstered the research as it showed the different factors more clearly than just a qualitative research would have done.

The conditions were influenced by several factors, which in this thesis were described as informational, economic, political and social (see table 5 for factors that were most important). The understanding of the ecosystem has been the most influential in making farmers transition to agro-ecological farming. A lack of finances has been the biggest obstacle for implementation, although smart use of subsidies could support future investments. The conservative culture and lack of community support and trust were the biggest obstacle for transition. The framework of Runhaar et al. (2016) can be strengthened by including risk taking and natural factors.

Factors	Operationalisations	Positive (+) or negative (-) influence on transition
Information	Understanding of the ecosystem	+++
	Complexity	-
	Skills	+
	Costs and benefits	++
	Community of practitioners	++
Economic	Lack of finances and investment possibilities	- - -
	No market demand for agro-ecological products	-
	Costs and benefits (no visible proof)	- -
Political	Subsidies	++
	Adjacent policies	-
Social	Lack of community support and trust	- -
	Cultural setting	- - -
	Lack of innovativeness	-
	Responsibility for future generations	++
	Peer pressure	-

Table 5: Conclusion most important factors and operationalisations

The second part of the research discussed the possible interventions by stakeholders to influence farmer decision-making. Many interventions were mentioned in the theoretical framework but farmers focus only on a few: kick-start investments, examples (demo farms, trials), extra (free) labour, information about the costs and benefits and on how to implement practices. According to farmers providing good examples is the best way to get them to implement regenerative practices. Demo farms can serve as places for workshops and information sharing as is already happening on some farms in the territory. This can be pushed forward by NGO's and the government if they provide the extra labour to implement these practices and ensure the quality of implementation and knowledge sharing.

Photo 10: Community building; a meeting of the AlVelAl farmers

Financial support for trials solves both the obstacle of a lack of finances, as well as motivation, which for a large part depends on proving that practices work. As spatial distance matters for farmers examples need to be presented in farms similar to theirs. Providing free labour has been mentioned in the literature as a key move to get farmers motivated and enable them to experiment. NGO's and local governments can set up volunteer programs for the implementation of regenerative practices. Businesses are advised to make sure contracts include restoration efforts.

Community building and sharing information on how to implement practices has proven beneficial for the motivation, ability and legitimacy of transitioning. AlVelAl is already doing this by organizing events and could be supported by the local and regional governments.

Policy interventions are important in the long run, but changing subsidies of the CAP costs years, and is therefore not an intervention that farmers would focus on. AlVelAl could work together with the government to improve the regulations regarding regenerative practices. There are some local and regional options; like financing, risk coping mechanisms and renting out machinery. Governments are advised to revise their subsidy system by strengthening voluntary instruments that advocate for

regenerative practices and develop educational systems that include holistic systems thinking and do not focus on degrading land practices.

Although action is clearly needed in restoring heavily degraded land, much is still unknown when it comes to the why and how behind the agro-ecological farming system. It became clear that the system is extremely complex and interconnected and that not all practices are as easily implemented. Unfortunately it is not possible to find out what works, without doing extensive experiments.

8. Literature

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9. Annexes

Annex 1. Interview

This interview was used to interview the thirty farmers. The interviews were in Spanish.

Entrevista

Nombre y apellidos	
Edad de la persona	
Direccion de la finca completa:	
Correo electronico **Teléfono**	
nivel de educacion, que has estudiado?	
Superficie de la finca (ha)	
Desde cuándo la maneja la finca?	
Como has aprendido la maneja de agricultura?	
Como entiendes tu la agricultura ecologica/sustainable?	
Que problemas tiene en concreta con por ejemplo plaguas etc?	

Topic list

Interviews are semi-structured, in which the following topics will be discussed:

Identification of farming method:

- Que tipo de practicas haceis respect de agua, suelo, arboles, y biodiversidad?

Perspectivas futuras:

- Estarias despuesto a cambiar el sistema a una agricultura todavia mas sustenible?

Practicas	Porque estas practicas y no otras? Cuales son los obstaculos para hacerlo estas practicas? Cuales son las condiciones para hacerlo?
setos	
Muros de contencion /diques	
Riego/irrigacion	
Cubierta vegetal	
Humus/estiercol/ compost/ mantilla	
Labranza	
Manejo integrada de plagas	
Manejo integrada de animals (ovejas)	
Diversidad de cultivos	

polinizacion	
poda	

Identification and characterisation of conditions/factors:

Economic	Tu tienes un systema de control economico? La finca te da suficiente rendemiento para vivir bien? Que va mal? Tienes los costes muy altos, o esta el precio demasiado bajo, o tiene subvenciones? Cuento questa por hectare? Y que ingreso tienes por hectare? Cuanta subvencion tiene?
Social	Tu colaboras mucho con tus vecinos? Por que? Tu pruebas muchas cosas nuevas? Nuevas productos/pesticidas/practicas? Si haces cosas nuevas, tu crees tu vecino les parece bien lo que haces? O te apartan un poco como raro?
Informational	Has recibido un acesoramiento o workshop o taller de alguien? Es facil obtener informacion de pracicas agricolas? Quien da este informacion? La informacion es fiable?
Political	Que practisas quiere el gobierno de agricultores? Soporten a ti? Que son los subvenciones o reglas ambientales? Funcionan bien?

Annex 2. Method used to quantify the arguments made by farmers

The Following table shows how the data were quantified. When an arguments was made by a farmer, this was put into the table using a -1 or +1. For example: one farmer said he thought his neighbours' farm was ugly because it had weeds (ground cover). This argument was then placed in 'cultural setting', and 'peer pressure' under legitimacy. Arguments could be placed under multiple headings if this was deemed appropriate. In the end all the -1 and +1 were added up to get to a final score.

Condition	Operationalisation	Factors	operationalization								
Motivation	extent to which farmers are motivated to participate in agro1ecological practises	Economic	Impact of measures on					-1		-1	-1
			Costs & benefits	1	-1	-1		-1	-1		
			Investment possibilities	-1	-1	-1			-1		-1
		Social	Recognition		1						
			Rewards	1		-1	1				
			Responsibility for future	2	1	2		2			
			Values								
			Peer pressure			1		-1	-1		
		Informational	Education	1	1						
			Training						1		
			Understanding of the farm	2	1	1	-1	1	1		2
		Political	Bureaucracy	-1							
			Corruption								-1
Total											
Ability	Extent to which farmers are capable to act within, or enabled by an agro1ecological practise	Economic	Availability of new business		-1	2					-1
			Available finances	1	-1						-1
			Market conditions	1				-1			-2
		Social	Peer pressure					-1			
			Values			-1					
			Community support/trust		-1						
		Informational	Skills	1		-1	-1		1		-1
			Farming style		-1	-1		-1	1		
			Communities of practise	1	-1	-1		-1		-1	-1
			Research		1						
			Learning			1					1
			Information about benefits	2	-2	1	-1	1	1	-1	1
		Political	Involvement of NGO's			1					
			Support from government		-1						
Total											
Demand	Extent to which farmers are requested or obliged to participate in agro1ecological practises	Economic	Environmental/market						-1		
			Demand for sustainable	1		-1			-1		-1
			Conditions in contracts with			-1			-1		
		Social	Public opinion about		-1						
			Religious values								
			Peer pressure								
		Informational	Understanding of request to			-2					-1
		Political	Pressure from NGO's								
			EU CAP subsidies	2	-1	1	2	2	1	1	-1
			Pressure from government								
Total											
Legitimacy	Extent to which farmers are allowed to participate in, and act within, agro1ecological farming	Economic	Working in a cooperative	2					1	1	1
		Social	Norms								
			Social control		-1			-1		-1	
			Peer pressure							-1	
			Cultural setting	-1	-1	-1		-1		-1	-1
		Informational	Innovativeness	1		-1			1		
			Community of farmers	1		-1			-1	-1	1
		Political	strictness of legislation and								
			Indirect effect of adjacent	-1	-1						-1

Annex 3. Data from INE.ES introducing the case study

3.1 Farms and the amount of hectares in percentage

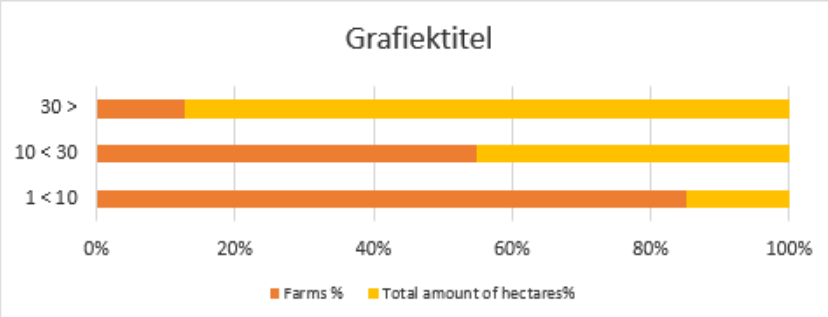
ANDALUCÍA. Encuesta sobre la estructura de las explotaciones agrícolas año 2013
Clasificación según superficie agrícola utilizada

Número, superficie total y superficie agrícola utilizada (SAU) de las explotaciones
Units: definidas en los valores de las variables

	Farms %	Total amount of hectares%
1 < 10	73,78	12,93
10 < 30	15,10	12,37
30 >	10,76	74,18

Notes:

Source:
National Statistics Institute



3.2 organic agriculture

ANDALUCÍA. Encuesta sobre la estructura de las explotaciones agrícolas año 2013
Clasificación según superficie agrícola utilizada

Producción ecológica
Units: nº de explotaciones y Ha.

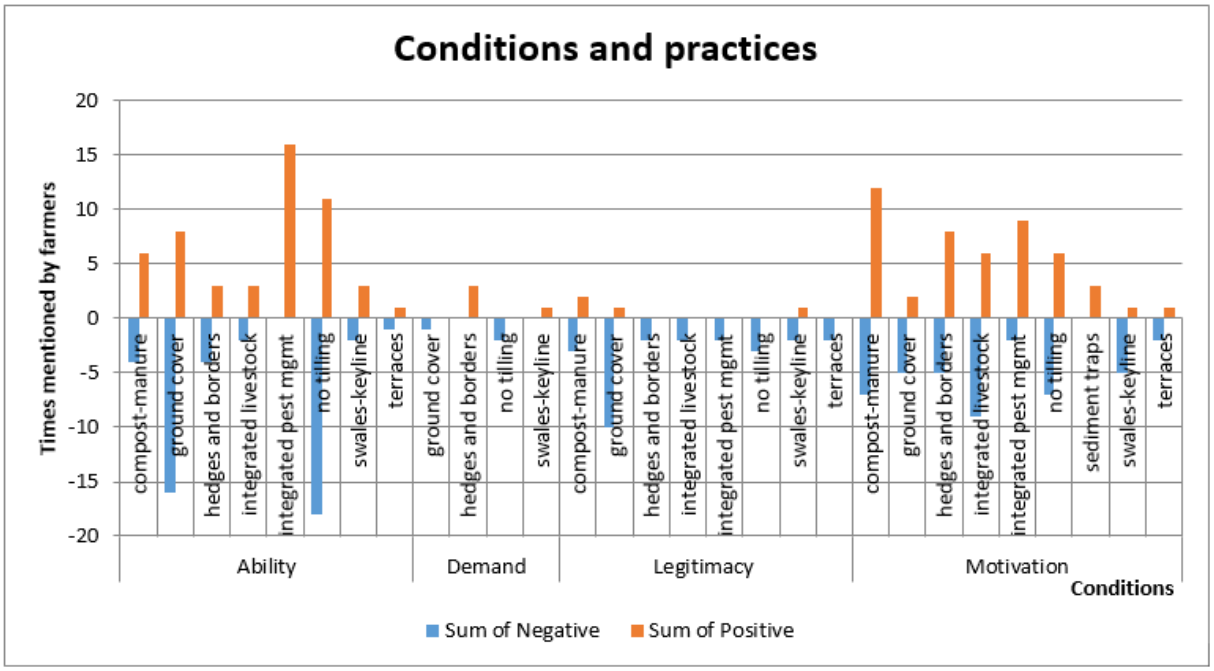
	Total		Calificada		En periodo de conversión	
	Explotaciones	Ha.	Explotaciones	Ha.	Explotaciones	Ha.
Explotaciones con SAU	7.572	203.162	6.644	184.998	1.065	18.164
< 1	340	146	340	146	..	..
1 a < 2	940	1.133	794	958	146	175
2 a < 5	946	3.566	779	2.774	167	792
5 a < 10	1.456	10.306	1.211	8.559	245	1.747
10 a < 20	954	11.837	806	10.240	157	1.596
20 a < 30	614	11.821	605	11.320	50	501
30 a < 50	591	16.136	495	14.304	96	1.832
50 a < 100	744	33.313	703	31.287	79	2.026
>=100	986	114.904	911	105.409	125	9.495

Notes:

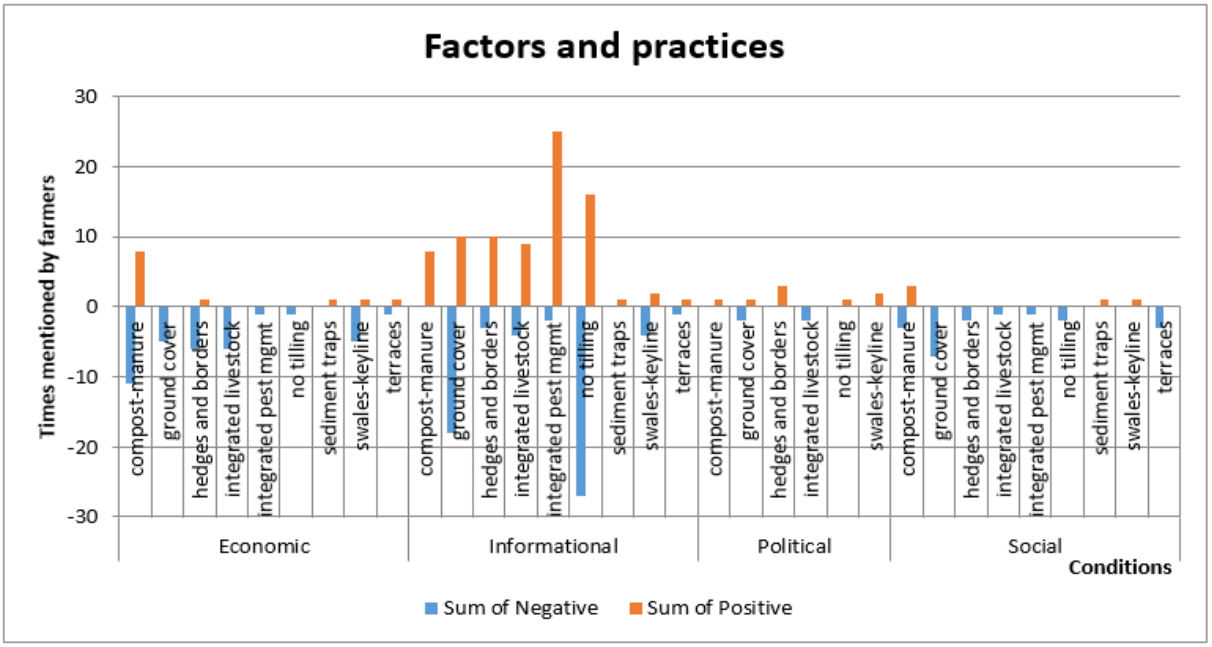
Source:
National Statistics Institute

Annex 4. Visualisation of conditions and factors per practice

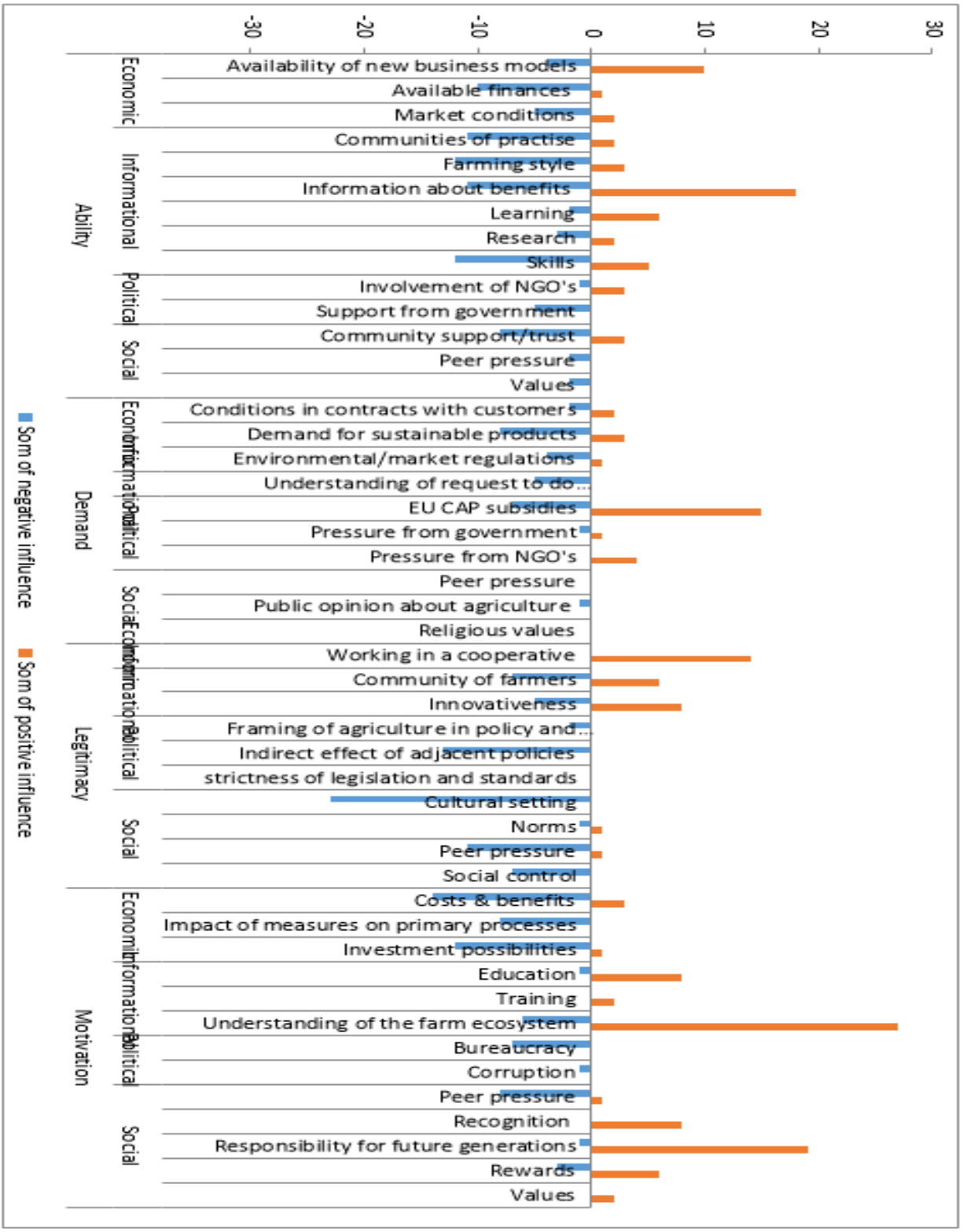
4.1 Conditions and practices



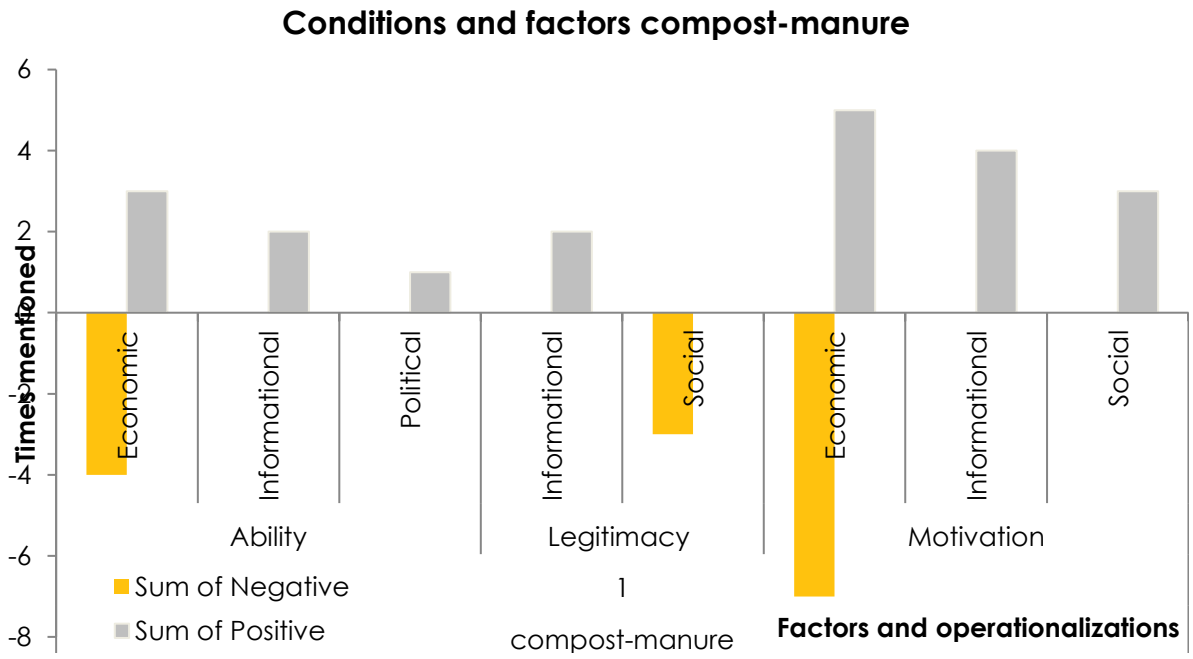
4.2 Factors and practices

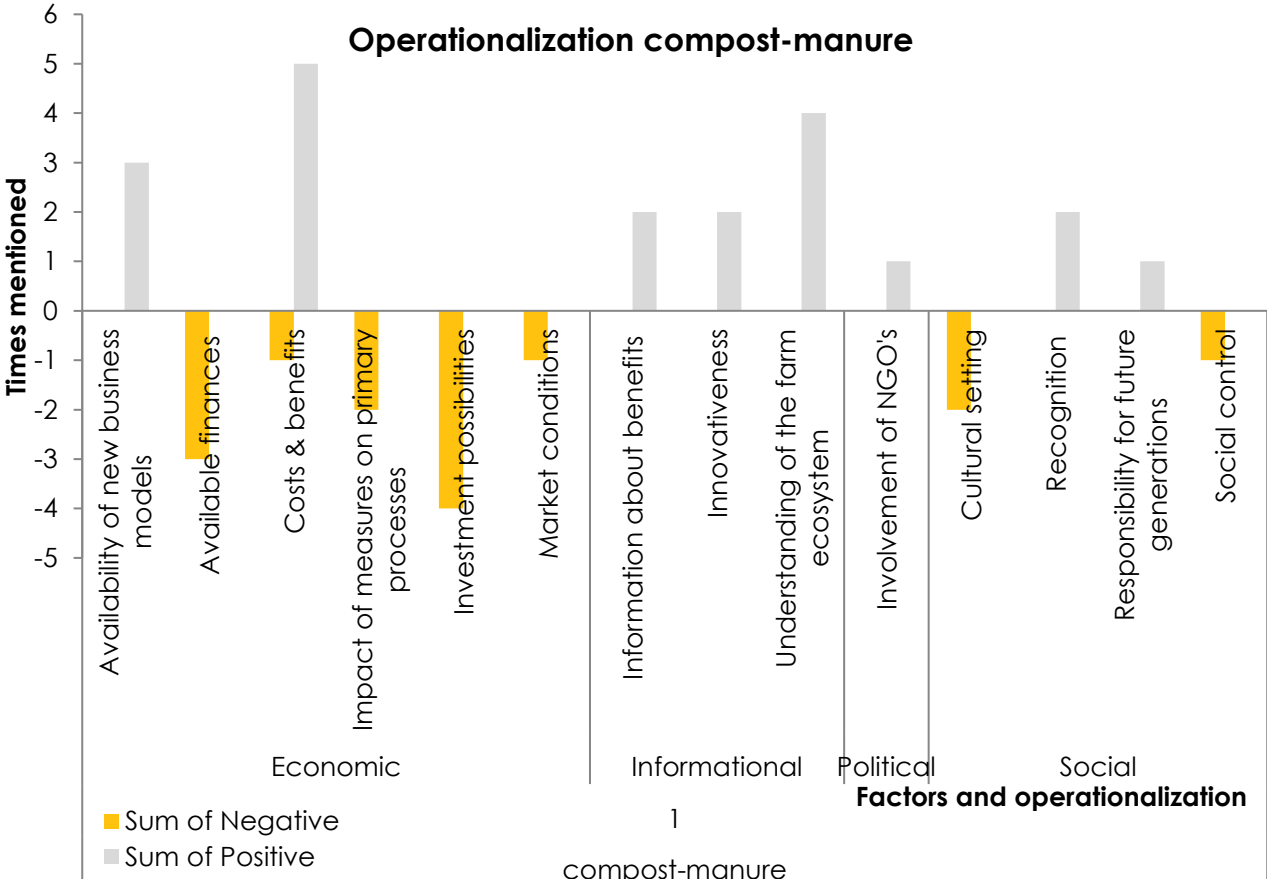


4.3 analysis of the interviews as a whole

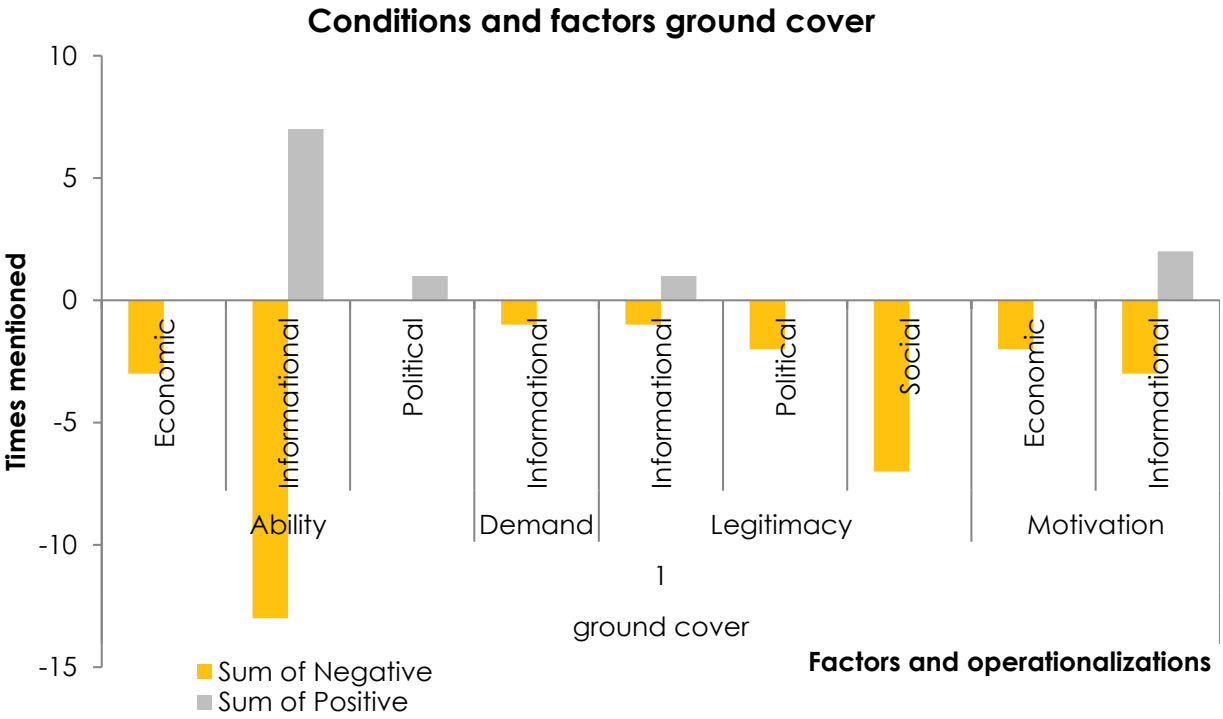


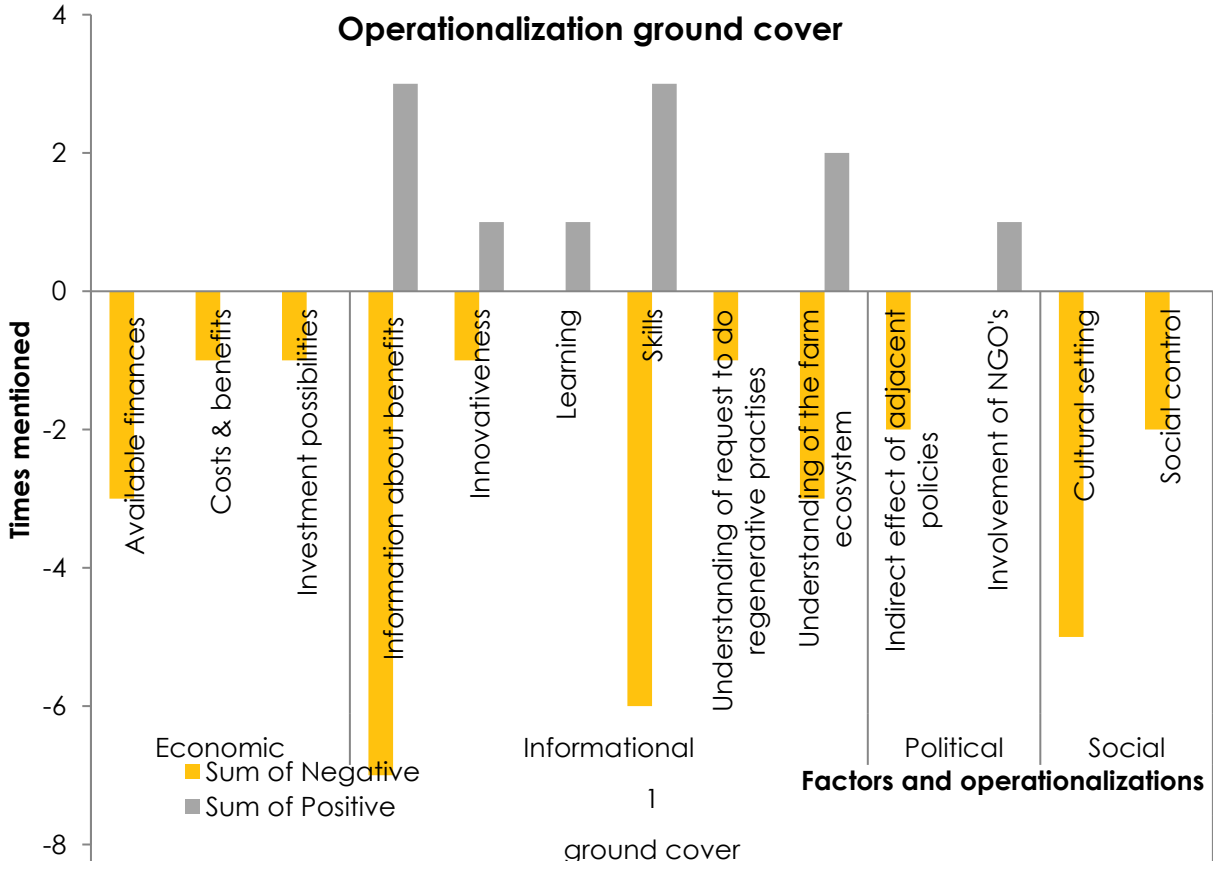
4.3 Compost


Conditions and factors compost-manure
Times mentioned
6
4
2
0
-2
-4
-6
-8
Economic
Informational
Political
Informational
Social
Economic
Informational
Social
Ability
Legitimacy
Motivation
Sum of Negative
Sum of Positive
1
compost-manure
Factors and operationalizations

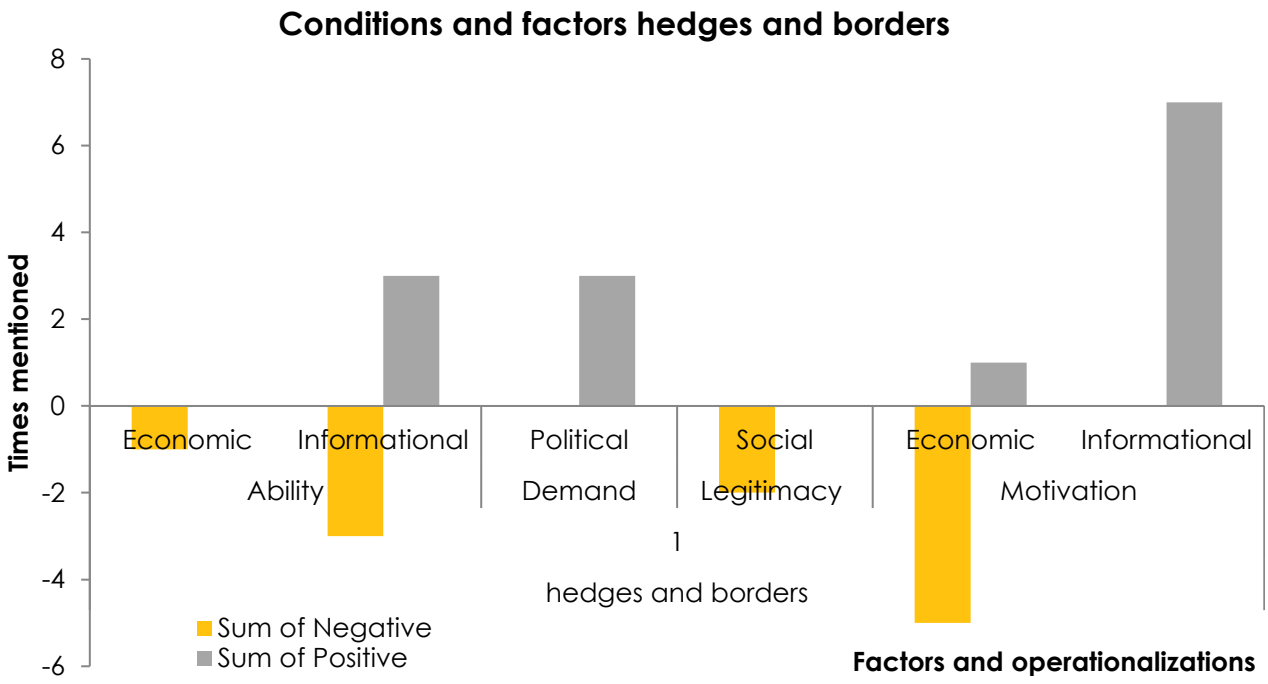

Operationalization compost-manure
Times mentioned
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
Availability of new business models
Available finances
Costs & benefits
Impact of measures on primary processes
Investment possibilities
Market conditions
Information about benefits
Innovativeness
Understanding of the farm ecosystem
Involvement of NGO's
Cultural setting
Recognition
Responsibility for future generations
Social control
Economic
Informational
Political
Social
Sum of Negative
Sum of Positive
1
compost-manure
Factors and operationalization

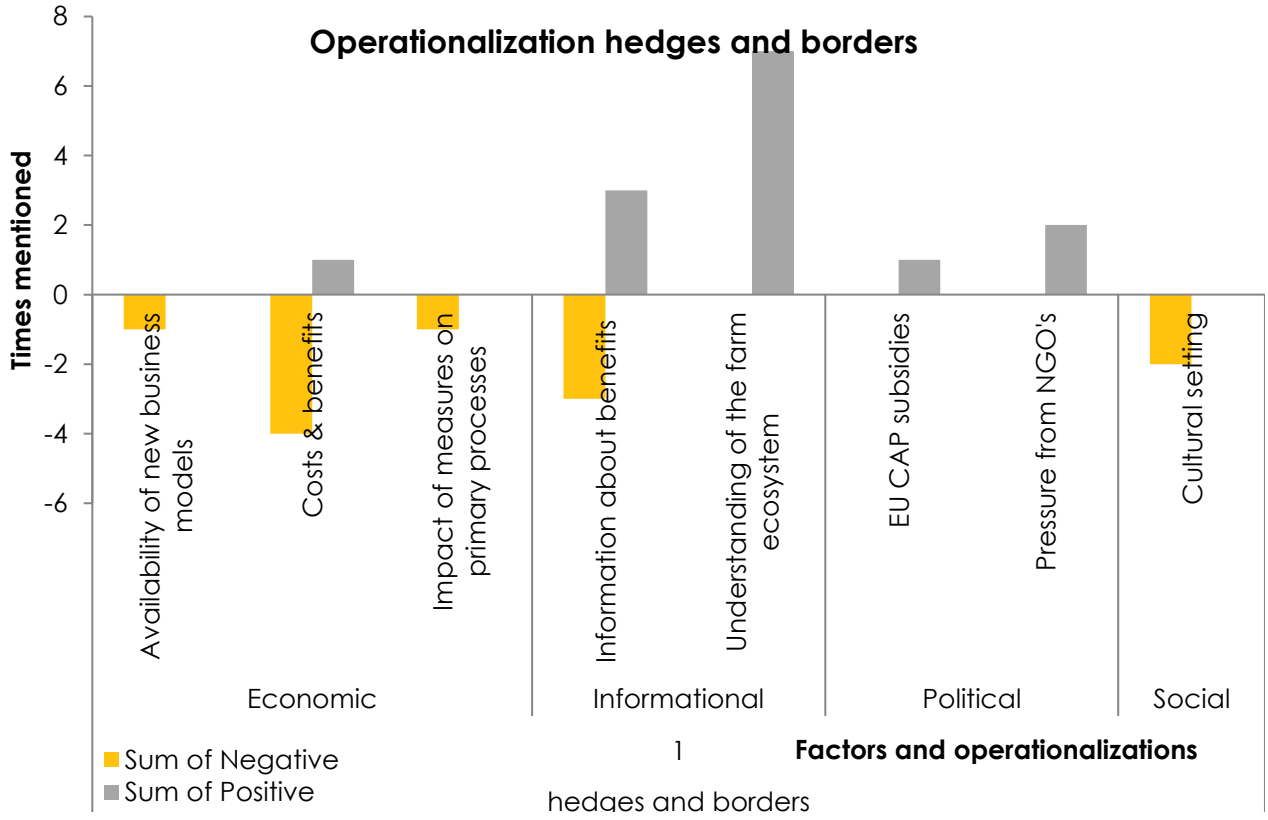
4.4 Ground cover



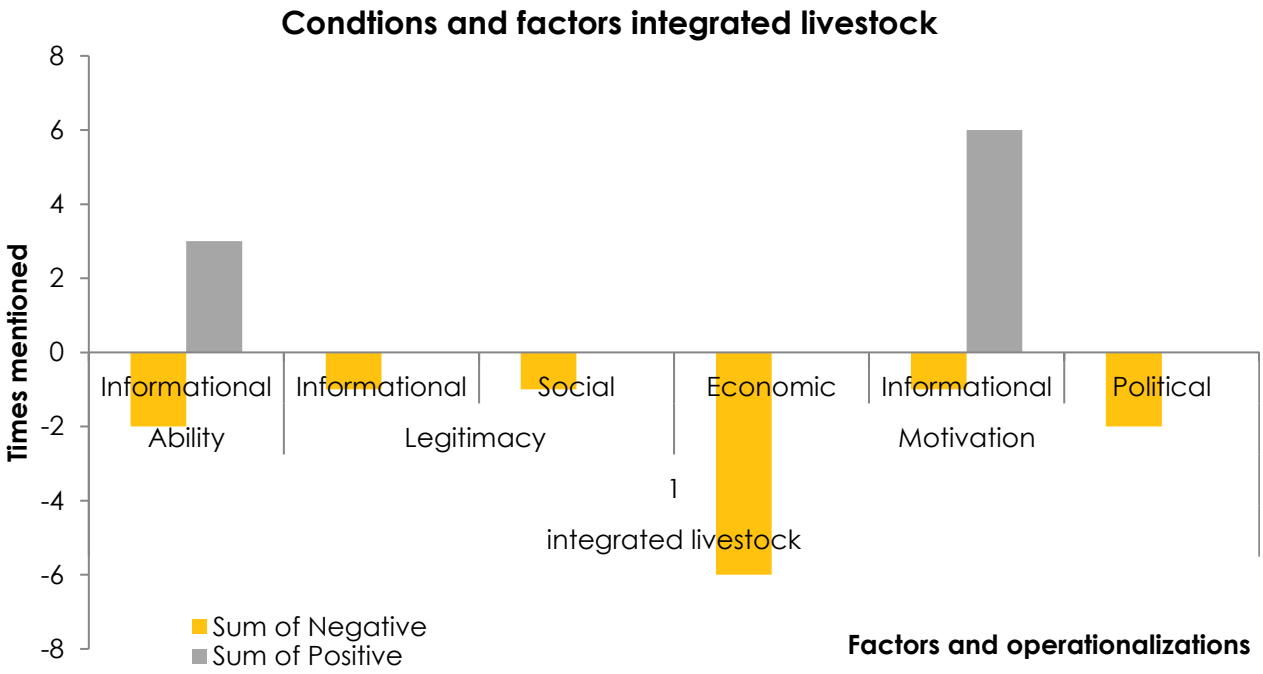


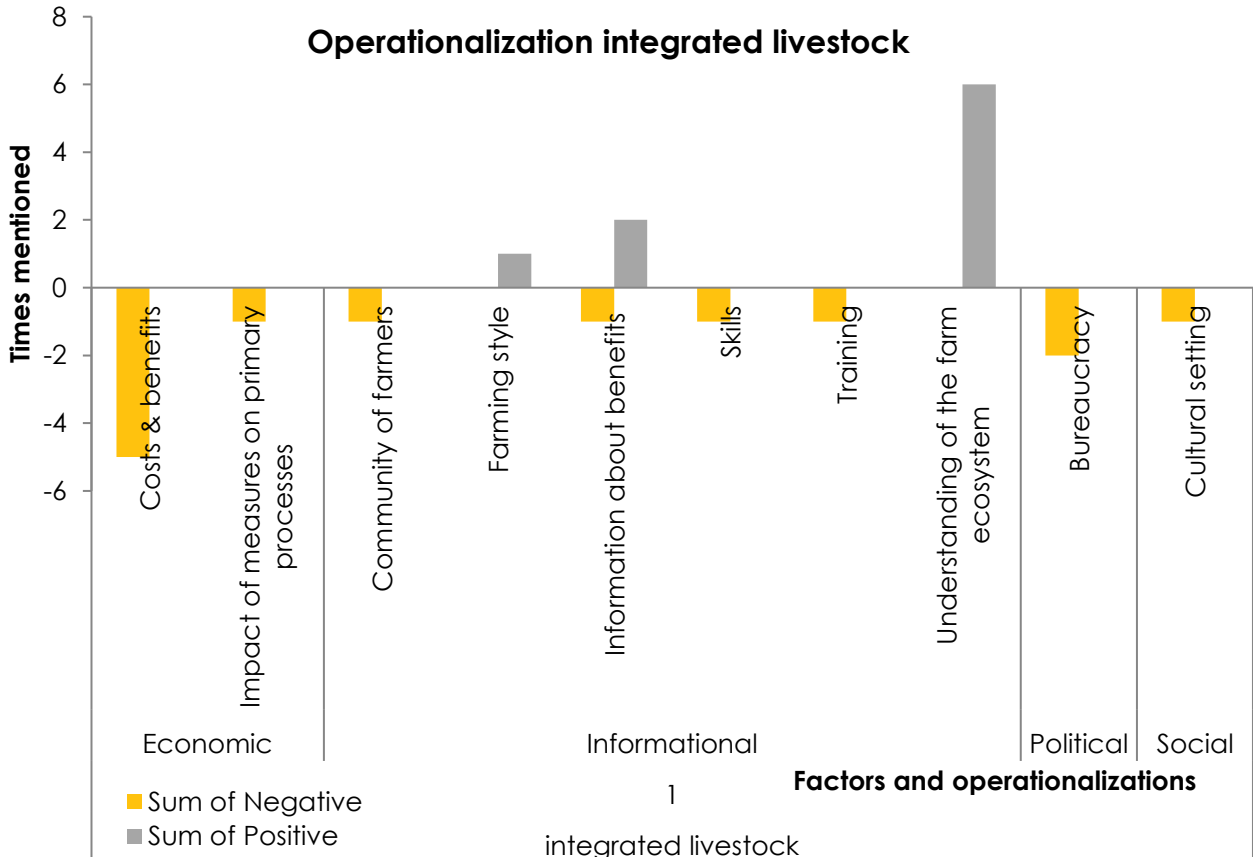
4.5 Hedges and borders



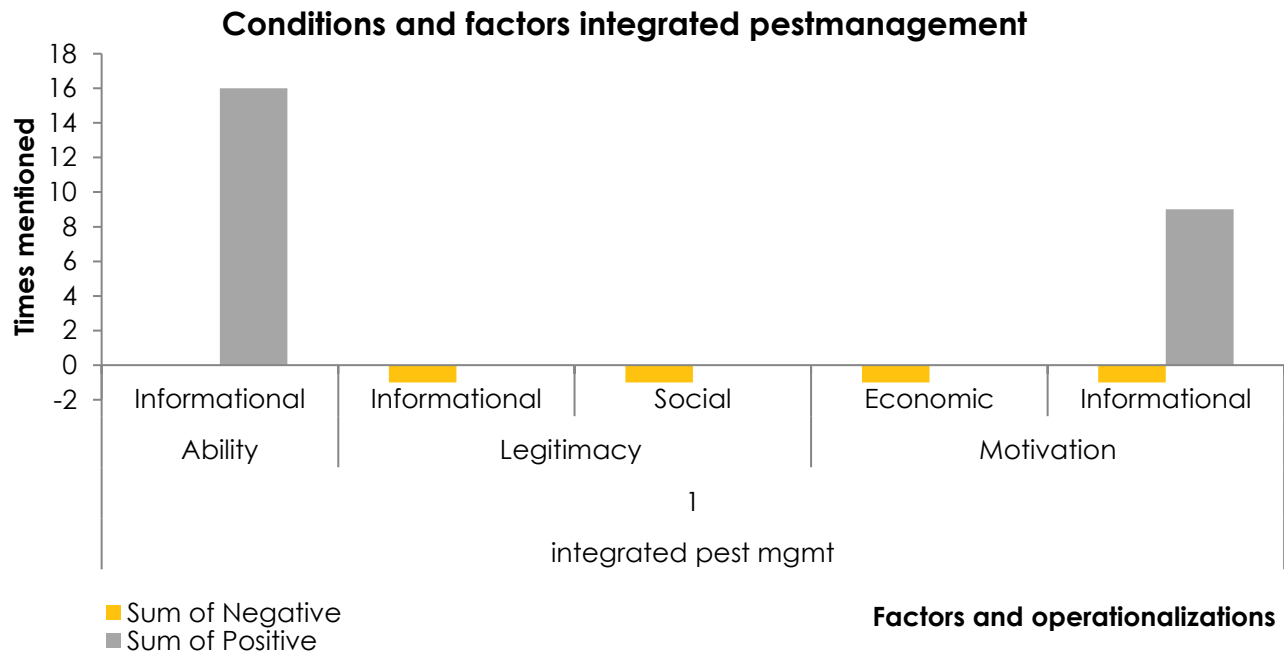


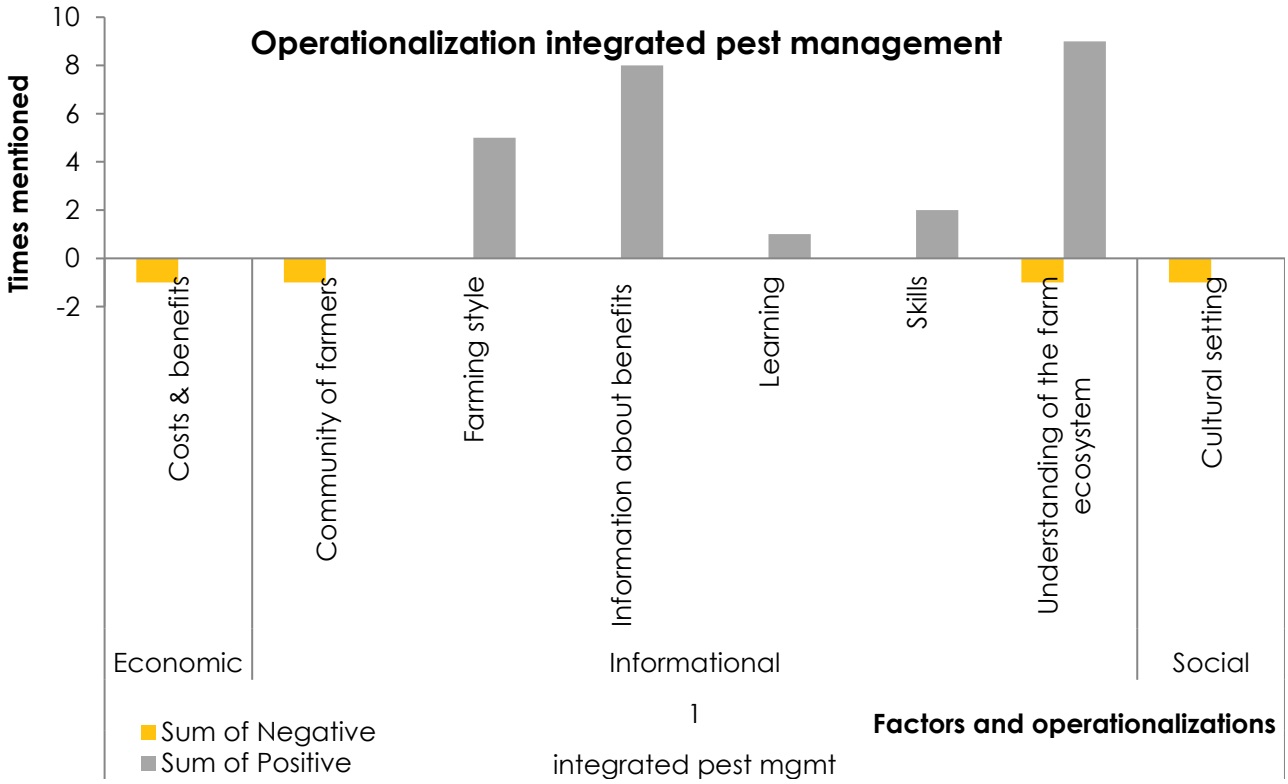
4.6 Integrated livestock



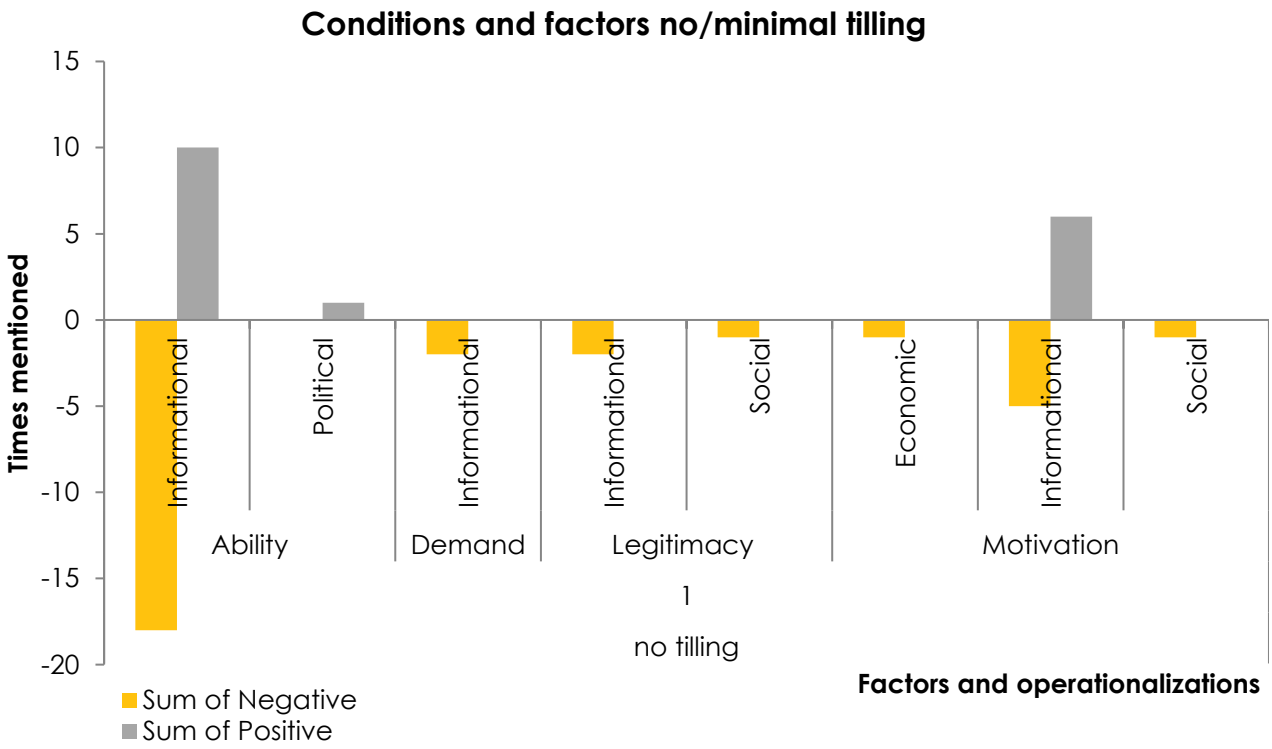


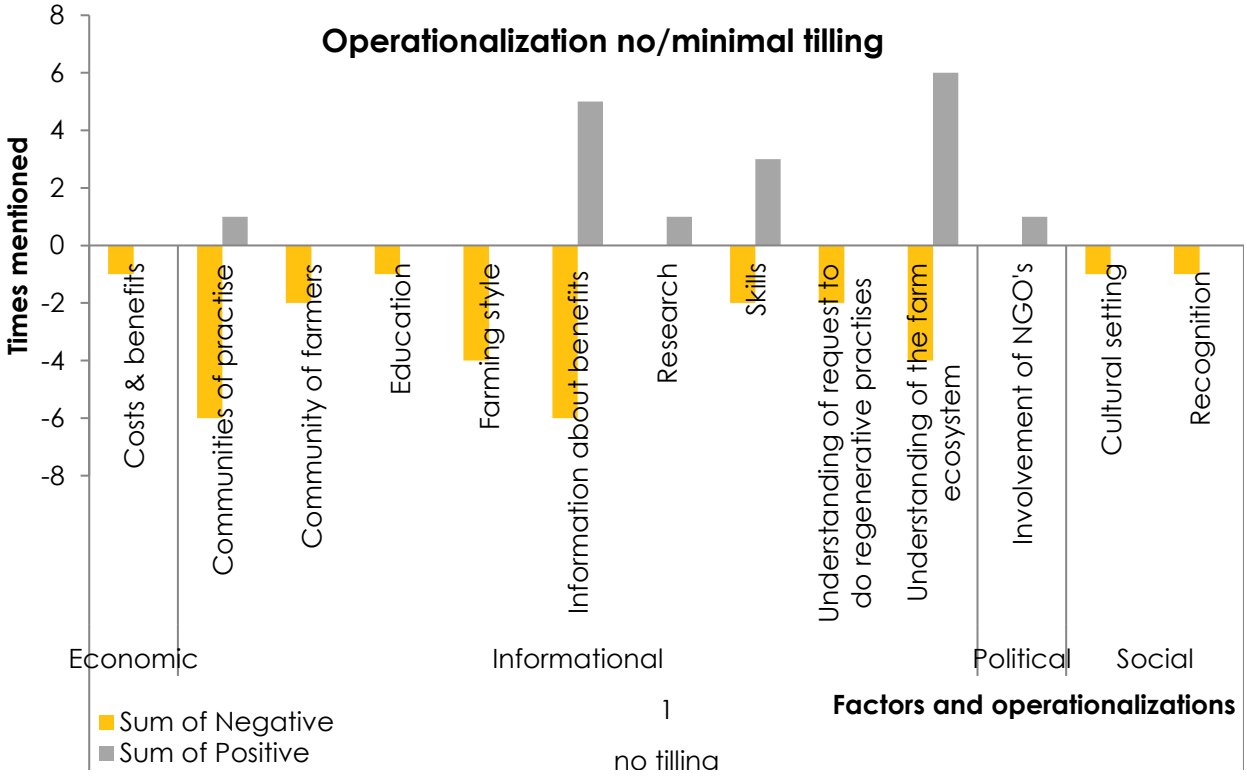
4.7 Integrated pest-management



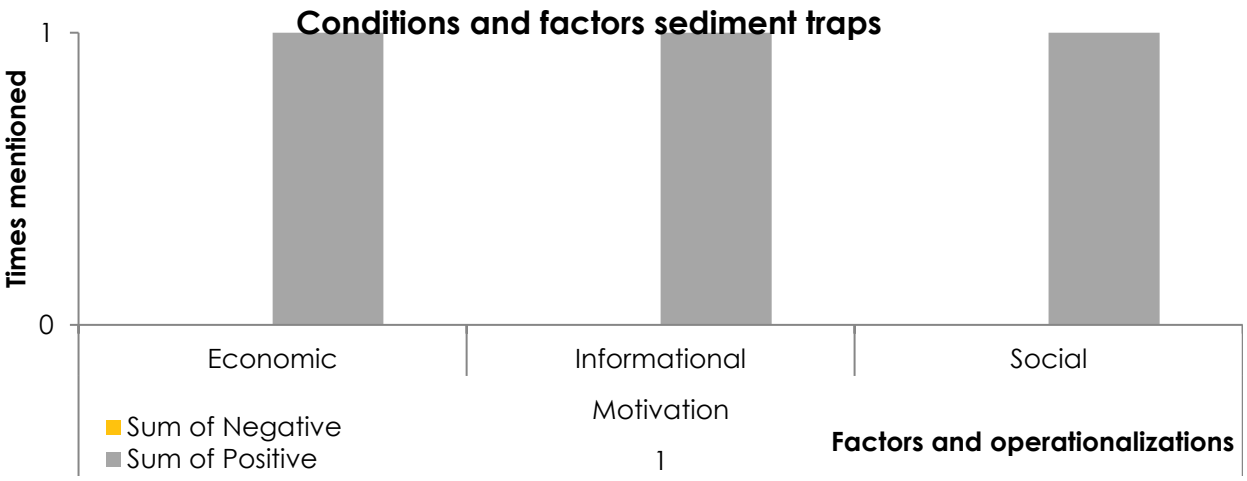


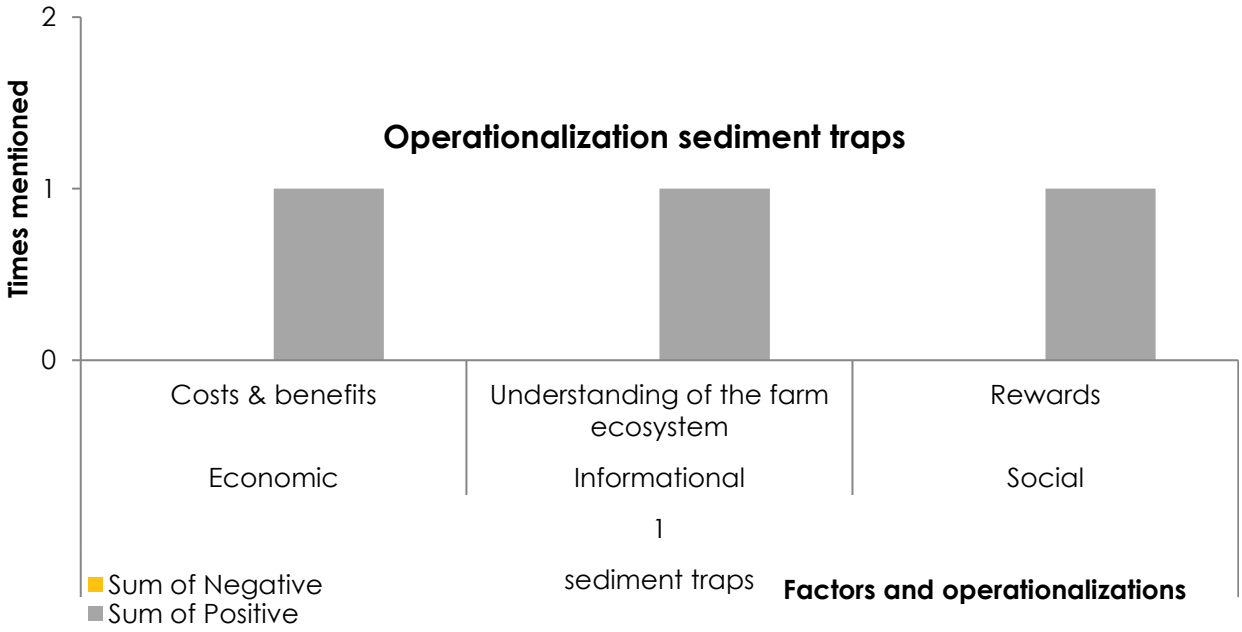
4.8 No/minimum tilling



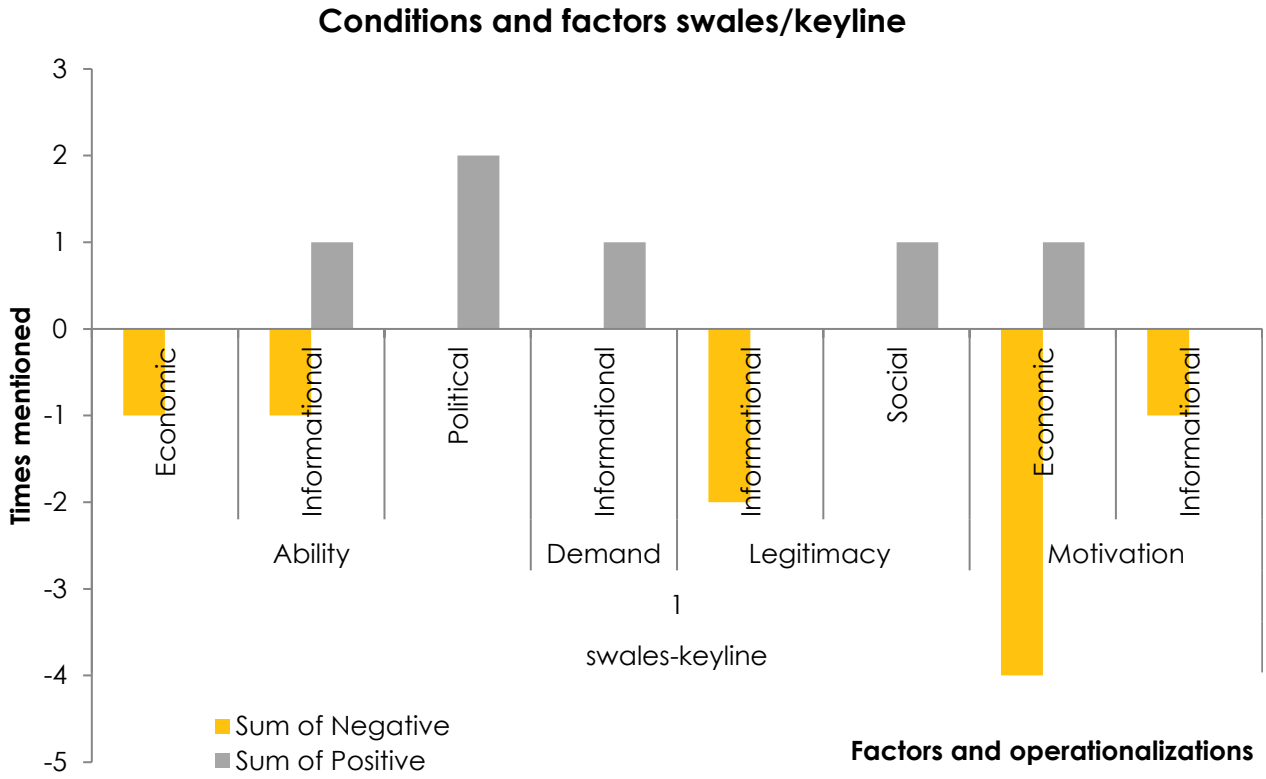


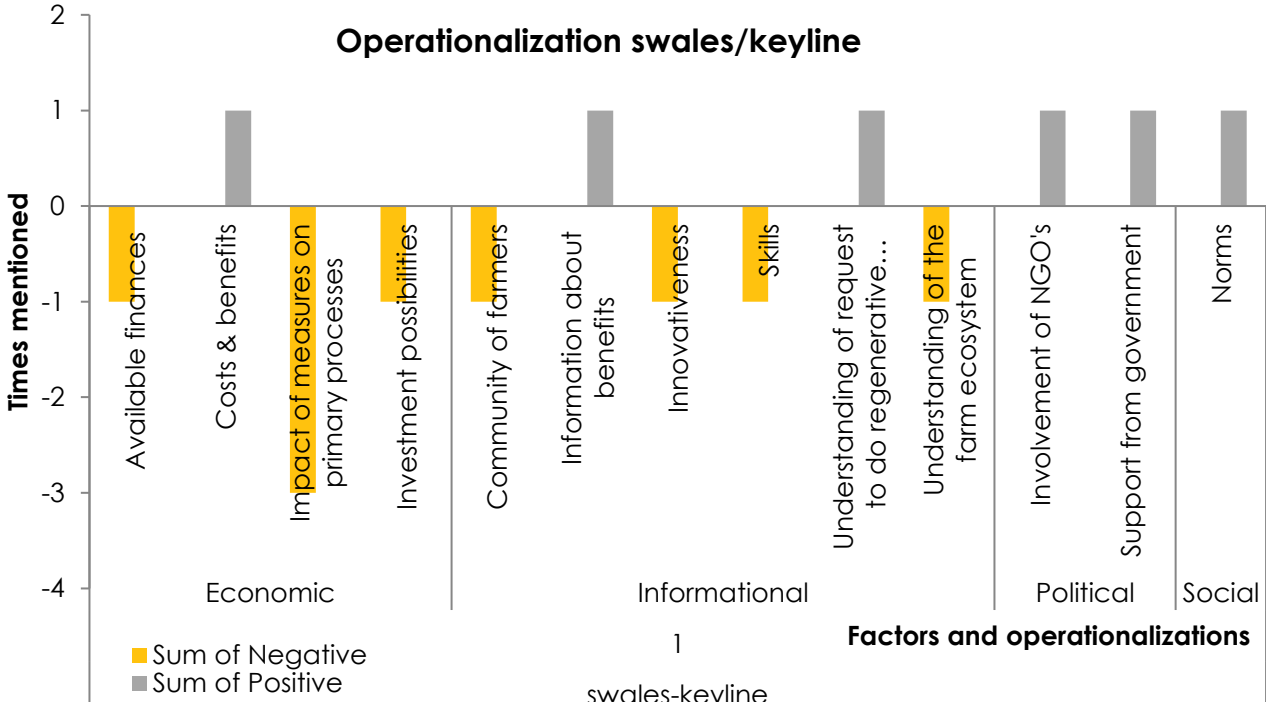
4.9 Sediment traps



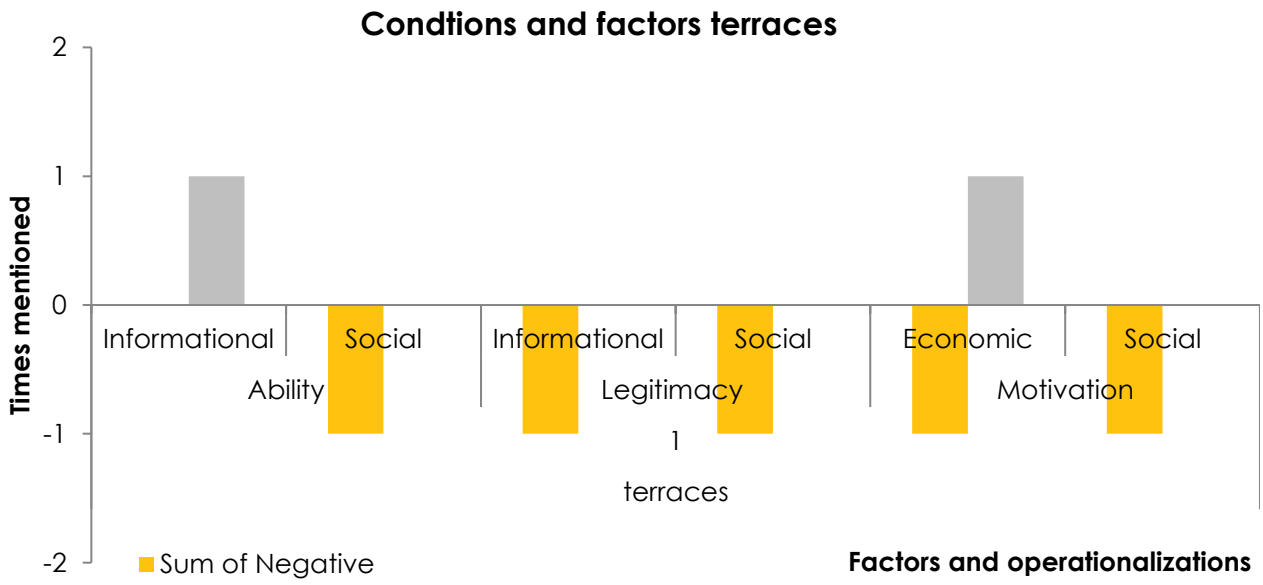


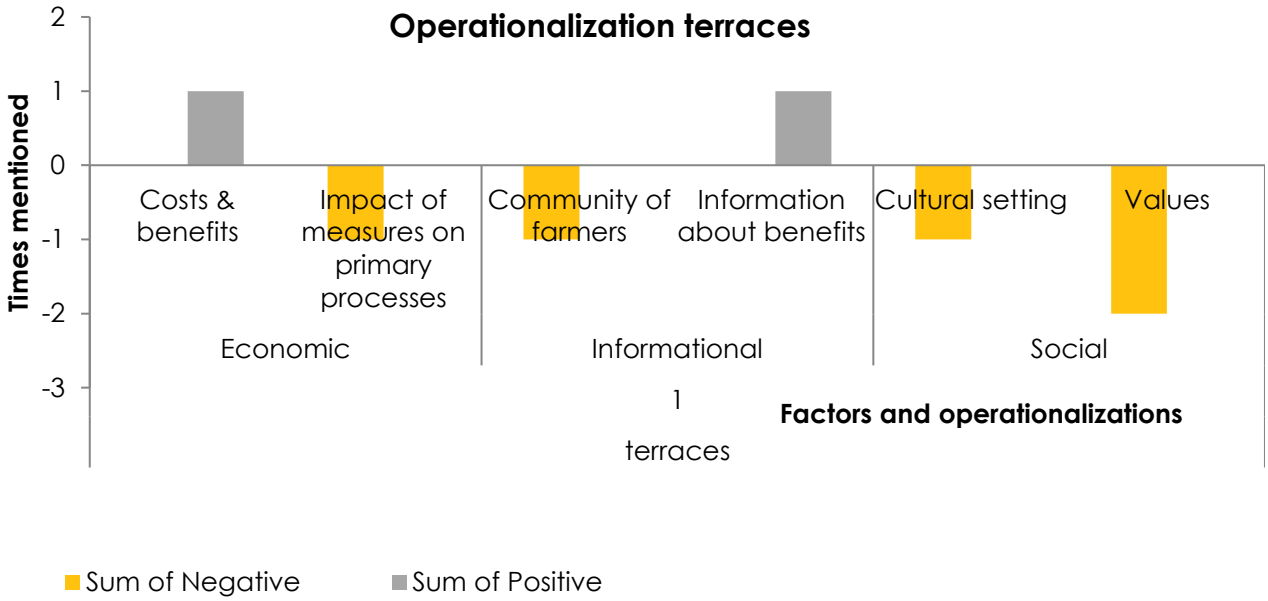
4.10 Swales/Keyline



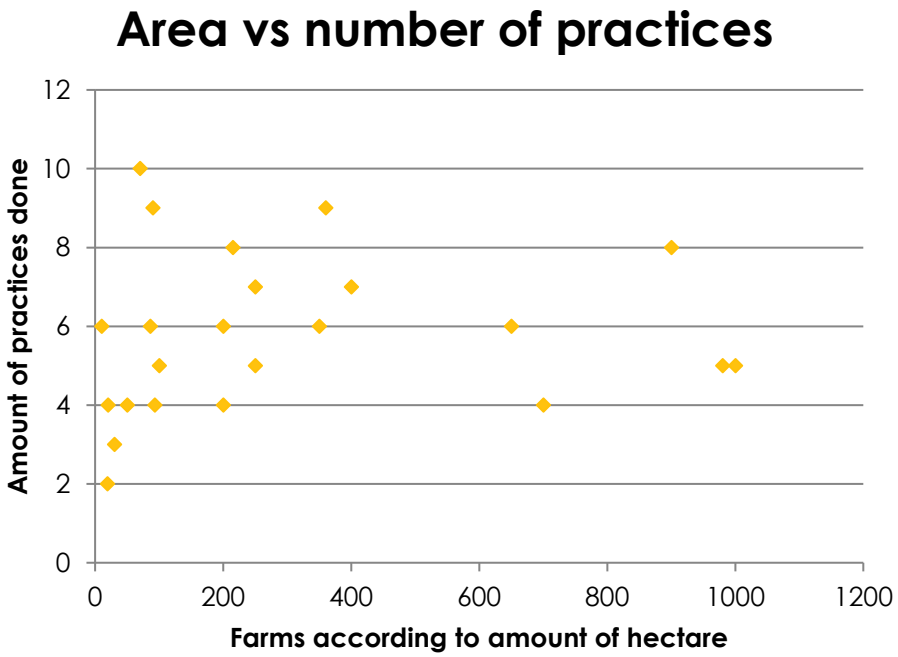


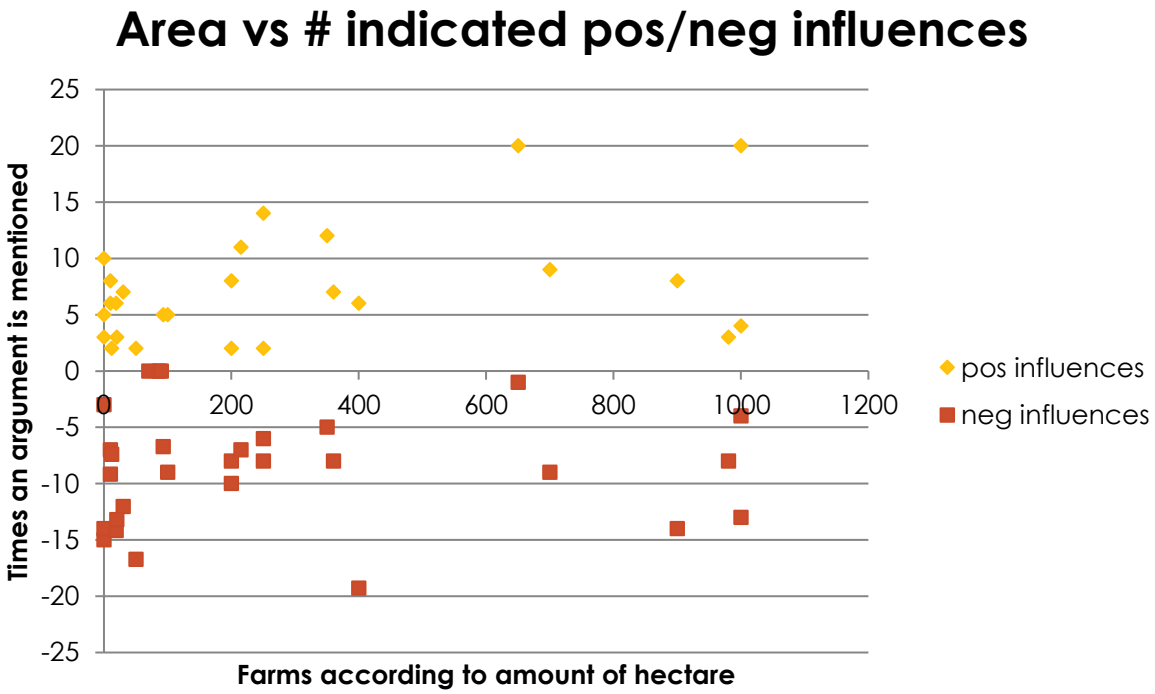
4.11 Terraces





Annex 5. Division of farmers in the area





Annex 6. Interventions linked to conditions and factors

Conditions	factors	operationalization	Possible interventions
Motivation	**Economic**	Impact of measures on primary processes	Free labour (Pannel, 1999); Grants and subsidies (Stonehouse, 1996)
		Cost benefits	Education (Uri, 1998); risk coping mechanisms (Kassam et al., 2012); Payment ecological services (Engel s., Pagiola S., 2008); voluntary instruments (Borgstrom et al., 2016); info about costs and benefits (Sánchez et al., 2014a); Free labour (Pannel, 1999)
		Investment possibilities	Grants and subsidies (Stonehouse, 1996); help with funding (Ferwerda, 2015); education (Uri, 1998)
	Social	Recognition	Communities of practice (Runhaar et al., 2016); Targeted promotions (Uri, 1998)
		Rewards	Performance contracts (Driessen et al., 2012); promotion of ecological products (Hart et al., 2016); labelling (Driessen et al., 2011)
		Degree of autonomy in choosing and implementing results	Self-crafted rules (Driessen et al., 2011); work together with other farmers to influence legislation (Baker & Eckerberg, 2013)
		Values	Education (Uri, 1998); norms and standards (Ahnstrom et al., 2009)
		Peer pressure	Community building (Runhaar et al., 2016; Borgstrom et al., 2016; Hart et al., 2016)
	Informational	Education	Education (Uri, 1998)
		Training	Technical assistance (Meyer, 2009); communities of practice (Runhaar et al., 2016)
		Understanding of the farm ecosystem	Education (Uri, 1998); info about costs and benefits (Sánchez et al., 2014a)
	Political	Bureaucracy	Technical assistance (Meyer, 2009); help by NGO's (Ferwerda, 2015)
		Corruption	Norms and standards (Ahnstrom et al., 2009)
Ability	**Economic**	Availability of new business models	Development of business models (Ferwerda, 2015); investment in social capital (Knowler & Bradshaw, 2007)
		Available finances	Grants and subsidies (Stonehouse, 1996); help with funding (Ferwerda, 2015); education (Uri, 1998); Development of business models (Ferwerda, 2015)
		Market conditions	Legislation; promotion of ecological products (Hart et al., 2016); Supply chain governance (Driessen et al., 2011)
	Social	Peer pressure	Community building (Runhaar et al., 2016; Borgstrom et al., 2016; Hart et al., 2016)
		Values	Education (Uri, 1998); norms and standards (Ahnstrom et al., 2009)
		Community support/trust	Creating farmer groups (Borgstrom et al., 2016; Runhaar et al., 2016); Education (Uri, 1998)

	Informational	Skills	Education (Uri, 1998); Technical assistance (Meyer, 2009); communities of practice (Borgstrom et al., 2016)
		Communities of practise	Creating farmer groups (Borgstrom et al., 2016; Runhaar et al., 2016); Education (Uri, 1998)
		Research	Educational programs (Uri, 1998)
		Learning	Educational programs (Uri, 1998); technical assistance (Meyer, 2009)
		Information about benefits	Education (Uri, 1998); risk coping mechanisms (Kassam et al., 2012); Payment ecological services (Engel s., Pagiola S., 2008); voluntary instruments (Borgstrom et al., 2016); info about costs and benefits (Sánchez et al., 2014a); technical assistance (Meyer, 2009)
	Political	Involvement of NGO's	Partnerships between stakeholders (Hart et al., 2016)
		Support from government	Work together with other farmers to influence legislation (Baker & Eckerberg, 2013); Investments in social capital (Borgström et al., 2016)
Demand	**Economic**	Environmental/market regulations	Norms and standards (Ahnström et al., 2009); Promotion of ecological products (Hart et al., 2016); Agri-environmental cooperatives (Sánchez et al., 2014a); Framing of sustainable agriculture by government and business (Driessen et al., 2011)
		Demand for sustainable products	Promotion of products (Hart et al., 2016)
		Conditions in contracts with customers	Supply chain governance (Driessen et al., 2011); Framing of sustainable agriculture by government and business (Driessen et al., 2011)
	Social	Public opinion about agriculture	Framing of sustainable agriculture by government and business (Driessen et al., 2011)
		Religious values	
		Peer pressure	Community building (Runhaar et al., 2016; Borgstrom et al., 2016; Hart et al., 2016)
	Informational	Understanding of request to do regenerative practices	Technical assistance (Meyer, 2009); targeted promotions and educational programs (Uri, 1998)
	Political	Pressure from NGO's	Awareness creation (Uri, 1998)
		EU CAP subsidies	Work together with other farmers to influence legislation (Baker & Eckerberg, 2013)
		Pressure from government	Work together with other farmers to influence legislation (Baker & Eckerberg, 2013); Partnerships between stakeholders (Hart et al., 2016; Runhaar et al., 2016)
Legitimacy	**Economic**	Degree of freedom with contracts/legislation	Norms and standards (Ahnström et al., 2009); Promotion of ecological products (Hart et al., 2016); Agri-environmental cooperatives (Sánchez

			et al., 2014a); Framing of sustainable agriculture by government and business (Driessen et al., 2011)
	Social	Norms	Education (Uri, 1998); create norms and standards (Ahnstrom et al., 2009)
		Peer pressure	Community building (Runhaar et al., 2016; Borgstrom et al., 2016; Hart et al., 2016)
		Cultural setting	Community building (Runhaar et al., 2016; Borgstrom et al., 2016; Hart et al., 2016); Parallel investments in social capital (Knowler & Bradshaw, 2007)
	Informational	Innovativeness	Development of new business models (Ferwerda, 2015); technical assistance (Meyer, 2009)
		Community of farmers	Community building (Runhaar et al., 2016; Borgstrom et al., 2016; Hart et al., 2016)
	Political	strictness of legislation and standards	Create norms and standards (Ahnström et al., 2009)
		Indirect effect of adjacent policies	Work together with other farmers to influence legislation (Baker & Eckerberg, 2013)
		Framing of agriculture in policy and communication	Work together with other farmers to influence legislation (Baker & Eckerberg, 2013)