Underlying values and motivational factors of farmers

- a study of Swedish farmers who use HVO in their productions

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Degree project/Independent project • 30 credits
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Agriculture Programme – Economics and Management
Degree Project/SLU, Department of Economics, 1431 • ISSN 1401-4084
Uppsala 2022

Underlying values and motivational factors of farmers - a study of Swedish farmers who use HVO in their productions.

Lantbrukares underliggande värden och motivationsfaktorer – en studie om svenska lantbrukare som använder HVO

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Credits:	30 credits
Level:	A2E
Course title:	Master thesis in Business Administration
Course code:	EX0906
Programme/education:	Agriculture Programme – Economics and Management
Course coordinating dept:	Department of Economics
Place of publication:	Uppsala
Year of publication:	2022
Cover picture:	Ellika Svenungsson, 2021
Copyright:	All featured images are used with permission from the copyright owner.
Title of series:	Degree project/Department of Economics
Part number:	1431
ISSN:	1401-4084

Keywords:	Biofuel, farmers' motivations, HVO, laddering, Means-End Chain, pecuniary and non-pecuniary values, The Zaltman Metaphor Elicitation Technique, value theory

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Abstract

The Swedish agriculture is yet to a large extent dependent on fossil fuels. In order to tackle climate change and attain the various environmental goals set by both public and private associations, there is an urgent need for the agricultural sector to transform to more sustainable production methods. Hydrotreated Vegetable Oil (HVO) is a biofuel that can be used in current machinery without any technical restrictions. Sustainable inputs, such as HVO, are today more expensive than non-sustainable alternatives. Further, traditional economic theories argues that producers are driven by economic incentives and strive to maximise profit. Hence, this study aims to gain insight into the motivational factors and underlying values as to why farmers use HVO in their productions. The elicitation and understanding of the motivational factors are key aspects in understanding how various stakeholders can support this transition through both private and public instruments. Existing literature is scattered regarding motivational factors in relation to the use of biofuel in agriculture. Through a qualitative approach ten farmers, who currently used HVO in their production, were interviewed to study motivational factors in an agricultural context. The Zaltman Metaphor Elicitation Technique (ZMET) and the laddering technique were used during the interviews and later the Means-End Chain theory (MEC) was applied to elicit the underlying motivational factors. The findings of this study suggest that "Responsibility" is the most prominent value followed by the values "Self- achievement", "Security", "Satisfaction" and "Legacy". Furthermore, profitability is not mentioned as a motivational factor as to why farmers use HVO in their production, but as a factor that enables the decision. Rather, the motivational factors elicited were of behavioural nature. Therefore, this study argues that there is a need for the development of new mental models that include non-pecuniary values in traditional economic theories.

Keywords: Biofuel, farmers' motivations, HVO, laddering, Means-End Chain, pecuniary and non-pecuniary values, The Zaltman Metaphor Elicitation Technique, value theory

Sammanfattning

Det svenska jordbruket är till stor del beroende av fossila bränslen. För att förhindra de negativa konsekvenser som följer av jordens klimatförändringar, samt möta de miljö- och klimatmål satta av flertal organisationer, krävs det en omställning till hållbara produktionsmetoder inom den agrara sektorn. Hydrerad Vegetabilisk Olja (HVO) är ett biobränsle som kan användas i dagens lantbruksmaskiner utan några tekniska restriktioner. Hållbara insatsvaror är idag dyrare än icke-hållbara insatsvaror vilket försvårar för lantbrukare att ställa om till hållbara alternativ. Samtidigt argumenterar traditionella ekonomiska teorier för att producenter drivs av vinstmaximering och andra ekonomiska incitament kopplade till lönsamhet. Detta kan sättas i förbindelse med de mentala strukturer som styr hur människor agerar i beslutssituationer och ligger till grund för syftet med denna studie, att undersöka vilka motivationsfaktorer samt värden det är som driver lantbrukare att använda HVO i sina produktioner. Befintlig litteratur om motivationsfaktorer i relation till biobränsle, och specifikt HVO, inom lantbruk är nästintill obefintlig. För att öka kunskapen hos intressenter i denna problemformulering, är framställandet och förståelsen för motivationsfaktorer hos lantbrukare viktiga aspekter att ta hänsyn till.

Studien har en kvalitativ ansats och genom intervjuer med tio lantbrukare, som vid studiens genomförande använde HVO i produktion, har motivationsfaktorer i en specifik lantbrukskontext studerats. Studien använder The Zaltman Metaphor Elicitation Technique (ZMET) i kombination med laddering technique under intervjuerna. Insamlad empiri analyseras sedan via Means-End-Chain theory för att därigenom framställa underliggande motivationsfaktorer hos lantbrukare. Resultaten av studien visar att värdet ”Ansvar” är det mest framträdande värdet, följt av ”Självförverkligande”, ”Trygghet”, ”Tillfredställelse” och ”Förvaltarskap”. Lönsamhet benämns inte som en motivationsfaktor för lantbrukarna, snarare som en faktor som möjliggör för dem att använda HVO. De framställda motivationsfaktorerna värderas istället som icke-ekonomiska faktorer. Denna studie argumenterar därför för att nya mentala strukturer som tar hänsyn till ovannämnda värden bör inkluderas i traditionella ekonomiska teorier.

Nyckelord: Biobränsle, HVO, Means-End Chain, laddering, ekonomiska och icke-ekonomiska faktorer, The Zaltman Metaphor Elicitation Technique, värdeteori

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Abbreviations

EU	European Union
GHG	Greenhouse Gas
HVM	Hierarchical Value Map
HVO	Hydrotreated Vegetable Oil
IPCC	Intergovernmental Panel on Climate Change
MEC	Means-End Chain
RED II	Renewable Energy Directive
RME	Rapeseed oil methyl esters
UNFCCC	United Nations Framework Convention on Climate Change
ZMET	Zaltman Metaphor Elicitation Technique

1. Introduction

The 2015 Paris Agreement requires all 196 included parties to outline their climate goals, with the common goal to keep global warming well below 2 degrees Celsius. The Intergovernmental Panel on Climate Change (IPCC) states that global emissions do not decrease at the pace needed (IPCC 2021). The agreement is silent on the topic of fossil fuels and lack enforcement to phase them out (Verkuijl *et al*. 2018). In November 2021, the United Nations Framework Convention on Climate Change (UNFCCC) arranged its 26th annual global climate summit, COP26. Despite fossil fuels being the key issues driving global warming (Arvidsson *et al*. 2011), in the 26 years these conferences have been held, this was the first time these natural resources were mentioned (Government Offices of Sweden 2020). The COP26 resulted in an agreement which calls on all parties to accelerate the phasing-out of coal and subsidiaries for fossil fuels. Hence, managing the transition away from fossil-fuels is recognised as an essential part of reaching climate goals by civil society, policy makers and researchers (Verkuijl *et al*. 2018). Amidst the challenge to combat climate change, global average temperatures as well as fossil fuel emissions continue to increase (Jackson *et al*. 2019). Thus, the IPCC (2021) calls for a change to happen.

The global agricultural sector, including forestry and other land use, stands for more than 20 percent of the total greenhouse gas (GHG) emissions and is connected to several negative consequences related to climate change (Jia *et al*. 2019; Sarkar *et al.* 2020). Sweden has a goal to be net zero in CO_2 emissions by 2045 in accordance with the Paris Agreement (Government Offices of Sweden 2020). The CO_2 emissions from the Swedish agricultural sector has not decreased the last years but rather remained unchanged, see Figure 1 (The Swedish Environmental Protection Agency 2020). Furthermore, agricultural work machines such as tractors and combines emit around 500 000 tonnes CO_2 emissions each year in Sweden (The Swedish Environmental Protection Agency 2021). Hence, there is an urgent need for the agricultural sector, together with other sectors, to shift to more sustainable approaches in order to tackle climate changes and achieve the goals (the United Nations n.d; Willett *et al*. 2019; Government Offices of Sweden 2020).

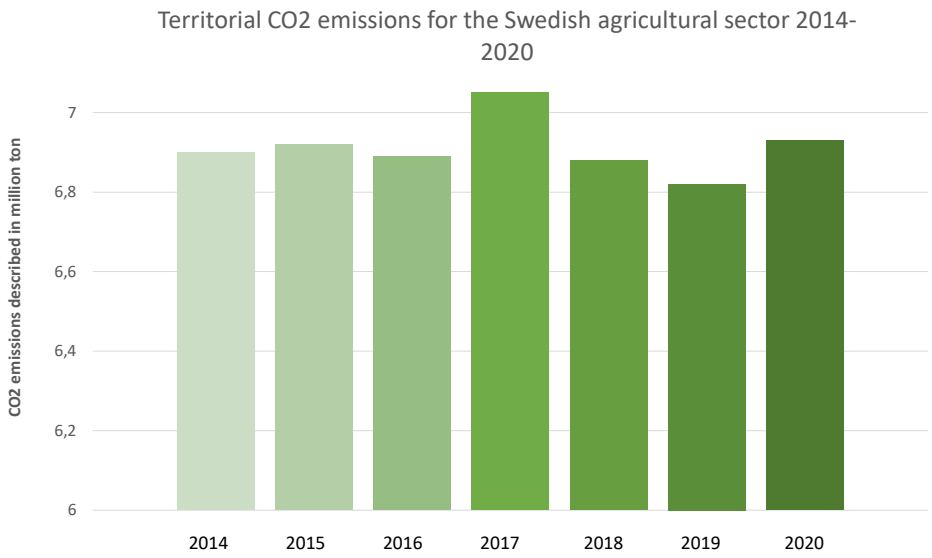

Figure 1. CO_2-emissions for the agricultural sector within Sweden (own work)

As described, Swedish agriculture is yet to a large extent dependent on fossil fuel, and hence a large emitter of CO_2 emissions. Renewable fuels such as biofuel, bioethanol and biodiesel are potential substitutes to fossil fuel (Bart *et al*. 2010). Efforts in developing potential alternatives to enable a transition from fossil fuel and reducing CO_2 emissions, have led to biofuel gaining attention world-wide (Sydney *et al*. 2019). Ahead of the climate summit in Paris in 2015, the Swedish government launched an initiative with the goal of Sweden becoming one of the first fossil free welfare countries (Fossil Free Sweden 2020). The initiative, named Fossil Free Sweden, has together with different industries developed roadmaps for how each sector can reach the goal of becoming fossil free. In the roadmap for a fossil free agricultural sector, a milestone is to be 100 percent fossil free by 2045 (*ibid*). The vision for the roadmap is in line with the Swedish food strategy, to throughout the period increase production within the industry in a sustainable way (Government Offices of Sweden 2016). With support from The Swedish Environmental Protection Agency (n.d.) the Swedish agricultural sector has to a large extent managed the transition to renewable energy within electricity and heating. Yet, facing the challenge to manage the same transition regarding tractors and other working machines. Hydrotreated vegetable oil (HVO) is an alternative to fossil fuel that enables farmers to convert to biofuel, without upgrading or changing current machinery park (Bezergianni *et al*. 2018; Suarez-Bertoa *et al*. 2019). Further, HVO is the most used type of biofuel in Sweden (Swedish Energy Agency 2021).

1.1 Problem Statement

There is unity among several actors which operate and influence the Swedish agriculture regarding the belief that Sweden has a leading role in the work of sustainability (Arla *et al*. 2021; Government Offices of Sweden 2021; Lantmännen

2019; LRF 2021). The Swedish Farmer Association (LRF) has, among other non-governmental organisations and agricultural media, stressed the increased costs for farmers due to the last years' increased prices of fossil fuel and other agricultural inputs (LRF 2021; LRF 2022). Further, the financial aspect is a key barrier for farmers who transform to sustainable agricultural production methods (Long *et al*. 2016). A newly innovated technology implies large costs or low profitability for the adapter (*ibid*). In Sweden, current prices for biofuel, such as HVO, are today more expensive than fossil fuel (Tanka 2022) Hence, a problem exists regarding sustainable innovation in agriculture and the use of HVO in agricultural production.

Traditional economic theory argues that producers are driven by economic factors and strive to maximise profitability (Debertin 2012; Howley *et al*. 2014). The theory is applicable for farmers as well, where constraints such as land use and farm machinery are included (Debertin 2012). Meanwhile, several studies highlight that farmers in general do not focus exclusively on financial factors when operating and developing their farm businesses (Hansen & Greve 2014; Howley *et al.* 2014; Hansson & Lagerkvist 2015). Instead, non-pecuniary values matter as well. Hansson and Lagerkvist (2015) conclude that farmers with animal production make decisions based on the decision's impact on animal welfare. Hence, other values than purely economic are of importance in this context. Continuing, Howley *et al*. (2015) discuss non-pecuniary benefits and how these play an important role in the question of transforming farmland into forestry. By solely considering pecuniary aspects, several motivation factors will be missed when analysing farmers' decision-making processes (*ibid*). Casimir (2017) highlights the fact that economic factors are argued to have most influence when farmers decide to change from fossil fuel to biofuel. Nevertheless, environmental, and personal factors also matter in the decision-making process (*ibid*). Profitability and monetary incentives are important factors when making decisions on farm-level. However, several non-pecuniary benefits influence the behaviour of a farmer as well (Gasson 1973; Löfgren & Olsson 2019; Kreutz & Peterson 2020). The investigation regarding a fossil-independent Swedish agriculture (SOU 2021:67 2021) states that economic incentives are today missing for a transition to use biofuel in farm businesses. As society, as well as the agricultural sector, develop in a more sustainable direction it is of importance to understand farmers' motivational factors as to why they use sustainable agricultural inputs in their productions. Therefore, it is interesting to study what underlying motivational factors affect farmers' decision to use HVO in their agricultural productions.

1.2 Aim and research question

This study aims to identify the underlying motivational factors for farmers who use HVO in their productions. Additional knowledge about this subject can increase the understanding among stakeholders and policy makers as to why farmers engage in sustainable agricultural transformations. Understanding the motivational factors as to why farmers chose HVO is a key aspect in understanding how this decision and transition can be supported by various public as well as private instruments. Further, this is of importance in order to design policy instruments which decrease emissions

and climate impact from the agricultural sector and thereby reach climate targets set by the sector as well as government. Based on the aim of this study, the following research question has been developed.

What are the motivational factors as to why Swedish farmers use HVO in their productions?

Previous research has successfully utilized the Means End Chain (MEC) theory together with the Zaltman Metaphor Elicitation Technique (ZMET) and laddering technique to elicit the underlying values that influence farmers' decision making (Hansson & Lagerkvist 2015; Hansson & Kokko 2018; Kreutz & Peterson 2020; Capetillo-Hernández, 2020; Blom & Danielsson 2021). The MEC-theory is applied to understand how values affect the way a person act and make decisions regarding product purchases. Further, the ZMET is applied in the interviews, together with the laddering technique to elicit the underlying values and motivational factors as to why the farmers use HVO in their productions. Even though the conceptual framework has been applied in contexts similar to this study, it has not been used in the specific context of this research. Hence, we argue that it is of interest to apply the laddering technique, together with the MEC theory and ZMET for investigating the motivational factors as to why farmers use HVO in their production. This framework of different methods and techniques will be introduced and further described in following chapters.

1.3 Delimitations and contribution

The study is delimited to interview farmers who currently use HVO in their productions. A transition to HVO from diesel is possible to perform without investing in new machines, since the properties of HVO are similar to diesel (Baky 2016; Bezergianni *et al.* 2018; Suarez-Bertoa *et al.* 2019). Since this study investigates the motivational factors as to why farmers use HVO and not why the farmers perform sustainable new investments, we argue that HVO is better to use as a study object rather than a fossil free fuel that would require farmers to invest in new machinery. Due to a limited number of farmers that use HVO, the study does not have any criteria or delimitations regarding the geographical location in Sweden. Nevertheless, this is not considered to have an impact on the result since the use of HVO is not dependent on the location of the farm. Additionally, the study is delimited to focus on the problem in a Swedish context. Hence, the farmers are impacted by Swedish regulations but may as well be affected by international policies.

The study is delimited to investigate the underlying factors as to why farmers use HVO and does not include sustainable approaches of the production of HVO. The focus point is the primary production and not the entire value chain. We are aware that the production of HVO has a negative environmental impact (Arvidsson *et al.* 2011). However, this study relies on previous studies describing that HVO emits less CO_2 emissions than fossil fuel (Dimitriadis *et al.* 2018; Suarez-Bertoa *et al.* 2019). A discussion about whether HVO is as a sustainable product or not, is not

considered since, as aforementioned, this study primarily focuses on the product HVO and why farmers use it.

Previous literature focuses on farmers' motivational factors when sustainable transitions or investments take place on a farm (Hansen & Greve 2014; Hansson & Lagerkvist 2015; Howley *et al*. 2015). Casimir (2017) performed a survey where farmers answered questions related to biofuel production and -use. However, no study has enlightened farmers' motivational factors behind the decision to use HVO in production. Therefore, the results presented in this study could possibly contribute to new knowledge and a deeper understanding to the study field of motivational factors and sustainable transitions in agriculture.

2. Background of biofuel and HVO

As per recent recast on the EU directive 2018/2001 on the promotion of the use of energy from renewable sources, biofuels are liquid fuels aimed for transportation and produced by biomass (European Commission 2018/2001). Further, a categorization is made based on the primary energy source used in the production, ecological impact and climate mitigation potential connected to alternative use of land from which the feedstock is derived (*ibid*). Established by the Renewable Energy Directive (RED II), the overall target regarding the integration of bio- and renewable fuels by 2030 is 30 percent (Directive 2018/2001/EU). Further, the directive specifies national targets for each country depending on starting point and potential for renewables, in line with the goals of 2015 Paris Agreement.

HVO is a biobased fuel that can be mixed with fossil diesel or used purely in both light and heavy-duty vehicles without technical restrictions (Suarez-Bertoa *et al*. 2019; Bezergianni *et al*. 2018). In 2019, 2.3 percent of the machines used in Swedish agriculture were run by pure biodiesel, including fuels such as HVO and rapeseed oil methyl esters (RME) (Swedish Energy Agency 2021). HVO has a similar chemical structure to fossil diesel and does not require agricultural machine engines to be changed (Aatola *et al*. 2009; Kiefel & Lüthje 2018; Jogner & Nojpanya 2021). The fuel can be produced from several raw materials such as rapeseed oil, palm oil, tall oil and animal fat including slaughterhouse waste (Aatola *et al*. 2009; Arvidsson *et al*. 2011; Karlsson Potter *et al*. 2020). The raw material is managed through a hydrotreated process to be refined to HVO (Aatola *et al*. 2009). No domestic production of HVO occurs in Sweden, hence the supply of HVO is dependent on imports from European countries and countries outside of the EU (Karlsson Potter *et al*. 2020; Swedish Energy Agency 2021). Sweden has potential to begin to produce HVO meanwhile it depends on several variables, such as supply of raw materials, as well as how the market of HVO is developing (Karlsson Potter *et al.* 2020; Karlsson Potter *et al.* 2021).

The integration of biofuels in Sweden is partly mandated by the Swedish government through the reduction mandate (SFS 2017:1201). The mandate requires transportation fuel distributors to gradually increase the share of biofuel in fossil petrol and diesel in order to reduce GHG emissions. The diesel used in Swedish agriculture is included in the reduction mandate. By 2030 the goal is to have a reduction level at 66 percent compared to 2021 when the reduction level was at 30 percent (*ibid*). This is followed by an estimated price increase between SEK 3.6-5.4 per litre of diesel (SOU 2021:67 2021). Swedish farmers can apply for a tax refund on diesel decided by the Swedish Government (The Swedish Tax Agency 2021). While this study was written the Swedish Government announced a

proposition which included an increased tax refund on diesel for farmers (2021/22:99). Due to the unstable situation in the world and increased domestic fuel prices, the Swedish Government argues for a change in order to help Swedish farmers. Further, an investigation about fossil independent agriculture, commissioned by the Swedish Government, states that the refunds have a large impact on both profitability and competitiveness for Swedish farmers since fuel costs are a significant expense for agri-businesses (SOU 2021:67 2021). However, since there is no tax on HVO and other biofuels, farmers who use HVO do not benefit from the previously mentioned tax refund (The Swedish Government 2021; SOU 2021:67 2021). With current policy instruments and tax systems it is more expensive for farmers to use HVO compared to diesel (SOU 2021:67 2021; Tanka 2022). In addition to increasing fuel prices in Sweden, other agricultural inputs increase in price. Therefore, it is of interest to investigate the motivational factors as to why farmers use HVO in their productions.

3. Conceptual and theoretical framework

3.1 Literature review

Previous to any research, a literature review is conducted to identify what is demonstrated by existing literature within the chosen field of interest (Bryman & Bell 2015). Moreover, the aim with the literature review is to create a solid foundation and a theoretical framework and thereby show the significance of the study (*ibid*). The focus of this study is motivational factors, value theory and sustainable transitions within agriculture. Studies to date have not yet determined the underlying motivational factors as to why farmers chose biofuel over fossil fuel in their productions. Hence, a review of previous research on motivational factors connected to sustainable transitions in agriculture assists the understanding for how to apply the concepts on this study. Further, the MEC theory has proven to be an appropriate approach when motivational factors are reviewed (Reynolds & Gutman 1988; Gutman 1997).

This study uses a narrative literature review since it is a well-established approach used to create a broad and comprehensive overview of the current knowledge of a topic (Ridley 2012). As abovementioned, the aim with the literature review is to gain an initial and broad understanding about the area of the topic chosen. The narrative approach with its lack of structure enables for a more general focus on a broad topic and would therefore be suitable for this study (Bryman & Bell 2015). The approach is commonly used when qualitative studies are conducted. Further, it is an essential part of the research process since it helps to establish the conceptual and theoretical framework. Therefore, with this framework as a foundation it will be possible to identify where current literature leaves a gap and thereby create a justified research question (*ibid*).

3.2 Values and motivational factors

Values and motivation are concepts that affect any human being, seen from behavioural aspects. This includes all humans, and therefore also the business owners and farmers that are the unit of analysis for this study. Values, as described by Schwartz (1992), are desirable overall goals, serving as guiding principles for what human consider most important in life. This definition will be used in present study when further analysing and discussing the underlying motivational factors as

to why farmers use HVO. Several stakeholders, both governmental and non-governmental, directly, and indirectly affect farmers and their decision making, as highlighted in Chapter 1. However, the decision lays with the farmer and is influenced by their underlying values and motivational factors. Hansson and Kokko (2018) state that it is of great importance to understand the mental models upon which farmers base decision making regarding their business. Mental models, as described by Hansson and Kokko (2018), are the cognitive structures behind an individual's values, beliefs, experiences, learning and biases about how the world is perceived. Several studies acknowledge that farmers' values affect their decision making (Willock *et al*. 1999; Lunneryd & Öhlmér 2009; Hansen & Greve 2014). Further, within value theory six main features exists (Schwartz 1992, 2012). One of specific importance and connection to the aim of this study, is the understanding of values as closely linked to the desired goal that motivates action (*ibid*). Moreover, what distinguishes between these values are described by the psychological literature as the underlying motivation that it conveys (Schwartz 1992; Schwartz & Boehnke 2004; Schwartz 2012). To understand the aim and drivers for value creation, ten broad values are defined (see Table 1) according to the motivation and underlying goal to achieve them (Schwartz 1992; Schwartz & Boehnke 2004; Schwartz 2012). The ten values which express the broad motivational goal are as followed: achievement, benevolence, conformity, hedonism, power, security, self-direction, stimulation, tradition, and universalism (*ibid*). Bardi and Schwartz (2003) state that the way these values are prioritised are individual and depend on a person's behaviour, attitude, and personality. These ten values and broad motivational goals will further be used in the discussion and conclusion of the results.

Table 1. Description of Schwartz's ten values, based on Schwartz (2012)

1. *Achievement:* Personal success through demonstrating competence according to social standards (ambitious, successful, capable, influential)
2. *Benevolence*: Preservation and enhancement of the welfare of people with whom one is in frequent personal contact (helpful, honest, forgiving, loyal, responsible)
3. *Conformity*: Restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectations or norms (self-discipline, politeness, honouring parents and elders, obedience)
4. *Hedonism:* Pleasure or sensuous gratification for oneself (pleasure, enjoying life, self-indulgent)
5. *Power:* Social status and prestige, control or dominance over people and resources (authority, social power, wealth, preserving my public image)
6. *Security*: Safety, harmony, and stability of society, of relationships, and of self (family security, national security, social order, clean, reciprocation of favours)
7. *Self-direction*: Independent thought and action—choosing, creating, exploring (creativity, freedom, independent, choosing own goals, curious)
8. *Stimulation:* Excitement, novelty, and challenge in life (daring, a varied life, an exciting life)
9. *Tradition:* Respect, commitment, and acceptance of the customs and ideas that traditional culture or religion provide (devout, respect for tradition, humble, moderate)

10. *Universalism*: Understanding, appreciation, tolerance, and protection for the welfare of all people and for nature (equality, social justice, wisdom, broadminded, protecting the environment, unity with nature, a world of beauty)

There are several reasons to why individuals are motivated to create values, and that these underlying values affect their decision making (Willock *et al*. 1999; Lunneryd & Öhlmér 2009; Debertin 2012; Hansson & Kokko 2018). The assumption that individuals make decisions based on their expected level of utility underpins the vast majority of economic models (Debertin 2012; Howley *et al.* 2015). As the concept utility can be difficult to measure, economists generally make the simplified assumption that money and profitability can be used as substitutes for utility (Debertin 2012; Howley *et a*l 2014; Howley *et al.* 2015). Further, agricultural economic theory would state that farmers make decision based on the assumption that they are rational profit maximisers (*ibid*). However, as stated by Gasson (1973) and other research, no decisions are strictly economic and these models therefore fail to account for the non-economic values that can underlie farmers' motivation, affecting their decision making (Willock *et al*. 1999; Howley *et al.* 2014; Howley *et al.* 2015). Gasson (1973) argues that farmers' values are not primarily economic, and some listed examples of values mentioned are to be one's own boss, have a healthy working environment, individual wealth, to have a meaningful work and to meet professional challenges (i*bid*). Further, studies suggest that non-pecuniary factors have a vital impact on farm size, farm manager and farm system (Howley *et al*. 2014; Howley *et al*. 2015). Previous literature has enlightened that both pecuniary and non-pecuniary factors motivate farmers to work with improved animal welfare (Hansson & Lagerkvist 2015; Owusu-Sekyere *et al*. 2021). Hansen and Greve (2014) investigated values of dairy farmers and how these affected their decision making. Their findings that farmers have many different values, apart from mainly economic ones, are in line with the findings of Gasson (1973). Despite the basic understanding of economic theory that farmers, likewise any businesses, should be driven by profit maximization, recent literature suggest that non-pecuniary aspects affect the decision making (Hansen & Greve 2014; Hansson & Lagerkvist 2015; Howley *et al.* 2014, 2015).

3.3 Motivational factors in relation to sustainable agriculture

In terms of decision-making, an individual chooses between several alternatives with different degrees of risk (Al-Tarawneh 2011; Hardaker *et al*. 2015). Hardaker *et al*. (2015) highlight that risks involve individual values which need to be taken into consideration when making decisions. Further, values differ and affect how actions are performed in different contexts (Schwartz 2012). As aforementioned, values stand for important matters in a person's life which can be ranked differently depending on the person (Gasson 1973; Bardi & Schwartz 2003; Schwartz 2012). It is of relevance to acknowledge decision making in an agricultural context (Hardaker *et al*. 2015). In implementation of new strategies and technologies,

farmers consider economic and non-economic values in the decision-making process (Weersink & Fulton 2020).

A transition away from fossil-fuels is needed to decrease the risks of increased climate changes and higher temperatures (Jackson *et al*. 2019; IPCC 2021). The transition to a sustainable future requires several dimensions to be considered. Economic, environmental, and social perspectives need to be highlighted (Amui *et al.* 2017). Further, to sustain sustainable businesses and thereby a sustainable society, technology and innovation must be incorporated in businesses' management and strategies (McCormick *et al*. 2016; Amui *et al*. 2017). Previous research states that studies concerning sustainable transitions in agriculture mainly focus on socio-economic perspectives (Borges *et al*. 2014; Mellon-Bedi *et al*. 2020). Meanwhile, various studies have highlighted the value of including psychological aspects as well (Morgan *et al*. 2015; Mellon-Bedi *et al*. 2020). In terms of sustainable transitions in agriculture, productivity benefits are one reason for farmers when adoption of sustainable methods occurs (Kragt *et al*. 2017). Furthermore, social values and social influences from family, neighbours and other stakeholders are likewise as important (Mellon-Bedi *et al*. 2020). Weersink and Fulton (2020) conclude that new mental models are necessary to better understand why farmers adopt sustainable transitions.

In recent years, researchers have investigated a variety of approaches to why farmers adopt more sustainable production methods (Pierpaoli *et al*. 2013; Borges *et al*. 2014; Mellon-Bedi *et al*. 2020). As abovementioned, a considerable number of published studies highlight the relevance of underlying values and motivational factors when investigating farmers' decision making (Gasson 1973; Lunneryd & Öhlmér 2009; Hansen & Greve 2014; Hansson & Lagerkvist 2015; Hansson & Kokko 2018; Mellon-Bedi *et al*. 2020). To understand farmers' mental models can lead to a better understanding for decisions regarding farm renewal (Hansson & Kokko 2018). Several techniques have been developed to identify these mental models. Previous to this study, researchers have successfully utilized the MEC theory jointly with the ZMET to understand underlying values that influence farmers' decision making (Hansson & Kokko 2018; Kreutz & Peterson 2020; Capetillo Hernández, 2020). While reviewing the vast literature on motivational factors for farmers to adopt sustainable farming practices, it becomes evident that there are no drivers that incessantly explain this adoption. Hence, as stated by Weersink and Fulton (2020), to understand sustainable adoption the understanding of the context and the local situation is of importance.

3.4 Means-End Chain Theory

The Means-End Chain (MEC) theory is a consumer behaviour theory aimed to understand how products can help consumers achieve desired values in life (Gutman 1982; Reynolds & Olson 2001; Costa *et al*. 2004). The theory is applicable in the study field of business and consumer behaviour theory but has also proven to be useful in agricultural research (Audenaert & Steenkamp 1997; Hansson & Lagerkvist 2015; Hansson & Kokko 2018; Kreutz & Peterson 2020; Blom &

Danielsson 2021). Therefore, the MEC theory is suitable for this study as well since the study seeks to understand motivational factors and values of farmers who use HVO in their agricultural productions.

The MEC theory is developed as a framework for understanding how consumers act and make decisions regarding product purchases in relation to their values and behaviours (Costa et *al*. 2004; Veludo-de-Oliveira *et al.* 2006). Based on personal values, a consumer can make both conscious and unconscious choices (Costa *et al.* 2004). The theory can explain a consumer's behaviour and decision making (*ibid*). Further, the theory assumes that consumers purchase a product for the direct and indirect benefits of it and not because of its immediate attractiveness (Reynolds & Olson 2001; Costa *et al*. 2004). *Means* are described as attributes related to the product while *ends* are interpreted as desired values stated by the consumer. In relation to agriculture and farmers' behaviours, this theory can assist in the understanding of why some farmers choose to use certain products, such as HVO. Furthermore, the theory explains that to each product or service, there are certain elements to which the consumers' behaviour are based upon (Gutman 1982; Reynolds & Gutman 1988).

Attributes (A) explain why a consumer chose a specific product while the *consequences* (C) and *values* (V) describe the aftermath of a consumer's choice (Gutman 1982). The elements can be described and visually presented in a hierarchical model, see Figure 2, to understand the relations between the elements. For each new elevation in the hierarchical model, the level of abstraction increases. *Attributes* (A) can be either physical or intangible characteristics of a product that are preferred by a consumer (Gutman 1982; Veludo-de-Oliveira *et al.* 2006). The *consequences* (C) are the perceived benefits which emerge when choosing a specific product. Meanwhile, Gutman (1982) argues that *consequences* may as well lead to unwanted effects depending on the consumer's acting. *Values* (V) can be described as solid and important matters for a person that do not change over time (Gasson 1973; Bardi & Schwartz 2003). Further, *values* have strong emotional impacts for a consumer and appear either as terminal or instrumental values (Veludo-de-Oliveira *et al*. 2006). An instrumental value is described as a mode of behaviour needed to achieve an end goal, such as being honest or having a thirst for knowledge (Gutman 1982). A terminal value is defined as an overall goal achieved over a lifetime, for example happiness or security (*ibid*).

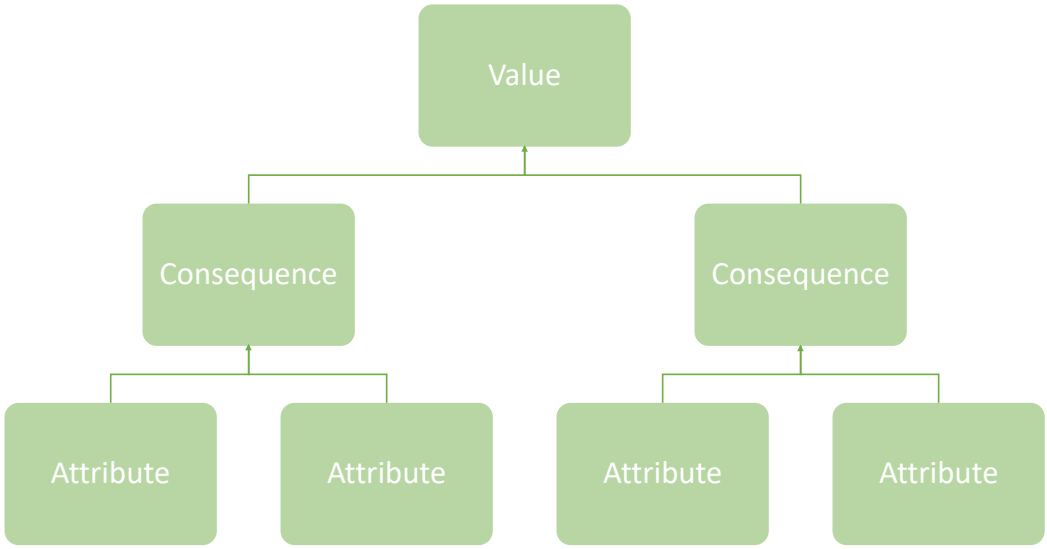

Figure 2. Hierarchical model of elements in the Means-End Chain theory (own work)

As aforementioned, researchers have utilized the MEC theory to explore motivational factors behind farmers' decision-making regarding investments and reactions to external factors (Hansson & Lagerkvist 2015; Hansson & Kokko 2018; Löfgren & Olsson 2019; Kreutz & Peterson 2020). This strengthens the argument to use the MEC theory for this study, since the aim of this study is to investigate farmers' motivational factors and values in relation to their choice to use HVO.

Several examples can be used to describe how the MEC theory can be applied in the present context used for this study. The mean is the fuel HVO and examples of attributes to HVO can be its quality, consistency or that it can be used as fuel. The consequences of a usage of HVO in production can be either positive or negative. A positive consequence may be that it is good for the climate (Sydney *et al*. 2019). However, it can lead to higher fuel costs for the farm business which is described as a negative effect (Long *et al*. 2016). Notable examples of a value applied in this context can be responsibility or pride. As aforementioned, the focus of this study has not been excessively researched before. Therefore, a key advantage of using the MEC theory, in combination with the ZMET and laddering technique, is that it can provide a deeper understanding in the given research field as well as unfold for further research within the subject field.

4. Method

4.1 Research philosophy

Regardless of study approach, the philosophical perspectives are of importance to understand the research paradigm. (Myers 2020). The epistemological approach in this study has an interpretivist stance (Bryman & Bell 2015). Meaning, knowledge about society differs between individuals and is therefore interpreted from subjective perspectives (*ibid*). Through interviews with different respondents, several subjective perspectives were produced and later analysed and generalised. Knowledge is obtained through social constructions in which language, values, and other aspects are considered to create an understanding of a context (Klein & Myers 1999). The farmers' answers elicited different underlying personal values connected to their decision to use HVO, which explains why this study has an interpretivist approach.

The ontological position of this study is constructionism. Bryman and Bell (2015) describe it as a view where social phenomena are influenced by actions constructed by social actors. Through interviews with farmers who use HVO in their productions, an increased knowledge of social phenomena concerning sustainable transitions can be attained (*ibid*). Further, Allwood (2021) argues that through communication with social actors a reality can be created, meanwhile it is affected by several variables such as interests and experiences. This study relied on its respondents and their perceptions of reality; therefore, constructionism was used in the study.

4.1.1 Qualitative approach

To create an understanding for how the research in this study was conducted, the choice and reason of chosen methodology is highlighted (Bryman & Bell 2015). This study uses a qualitative research approach since the aim is to understand farmers' motivational factors in relation to a specific context. The qualitative approach concentrates on communicated words rather than measuring data and numbers, as quantitative studies do (Bryman & Bell 2015; Creswell & Creswell 2018). Myers (2020) argues that it is within a context one truly understands why a person behaves in a certain way. The study intended to describe farmers' motivational factors as to why they use HVO. Kvale and Brinkmann (2014) highlight benefits of conducting interviews in qualitative studies. A deeper

understanding of the respondents' perspectives and reasonings is gained. By the use of the ZMET and the laddering technique, the respondents' underlying values could be elicited. The combined methodology, in combination with the application of the MEC theory, enabled disclosure of previously hidden values that motivate the farmers' decision to use HVO in their productions, which strengthens Myers' (2020) abovementioned argument. Bryman and Bell (2015) state that by using visual material a deeper interpretation of collected data can be achieved when using a qualitative approach. The ZMET uses visual content to elicit the underlying values, based on the idea that people think in images (Zaltman 1997). Hansson and Kokko (2018) support the argument for using the ZMET by stating that images enable identification of the respondents' underlying mental models, which lead to a more complete understanding of the collected data.

To answer the research question and thereby fulfil the aim of this study, both deductive and inductive research processes were used (Bryman & Bell 2015). Svensson (2009) argues that a deductive process commonly consists of an idea arising and then formulated through a research aim. By research of existing literature and a collection of empirical data, tested against the study's theoretical framework, conclusions can be outlined (*ibid*). This argument is strengthened by Bryman and Bell (2015) who highlight that a deductive process often follows a logic structure. For a deductive approach it is common that literature and theories beforehand have been tested and that the current study is conducted to further develop or prove the theory, which is the case for this study (Graneheim *et al*. 2017). Hence, this study approach is primarily deductive, although an inductive approach was applied when analysing the results conducted from the ZMET. Since limited knowledge exists concerning the studied issue, the results from ZMET will contribute to the generation of theory. The use of both processes helped the present study to explain and analyse the motivational factors as to why farmers decide to use HVO in their productions. Existing literature use similar interview methodology and theories to study sustainable transitions or innovations in agriculture (Hansson & Kokko 2018; Kreutz & Peterson 2020; Blom & Danielsson 2021).

4.1.2 Research design

The research design determines the methodology of the data collection as well as the analysis of it and present a plan for how to perform the study (Bryman & Bell 2015). Further, by describing the type of research design, the quality of the study can be assessed with regards to several criteria (*ibid*). For this study, a case-study approach was adopted to determine the underlying motivational factors that affect the farmers' decision-making to use HVO in their productions. A case-study approach is appropriate to use when the aim is to gain contextual, in-depth knowledge about a specific problem (Yin 2008). It can be used to reveal similarities and differences between studied objects, which correlate to the aim of this study, to elicit common values connected to the farmers. The aim is to map out these elements to understand the specific contexts in which the farmers operate in (Eisenhardt 1989; Yin 2008; Bryman & Bell 2015). For this study, the case was the farms using HVO in production while the unit of analysis was interviewed farmers

who have converted to HVO in their productions (Bryman & Bell 2015). Blom and Danielsson (2021) among other researchers (Jonasson & Sandlund 2017; Kreutz & Peterson 2020), have used the same research design when studying agricultural contexts with similar methodology approach. This strengthens the argument of applying a case-study approach since the conclusion can be used as support to the study field of sustainable transitions.

4.2 Course of action

4.2.1 Sampling of respondents

To answer the research question of this study and fulfil the aim, respondents were selected based on some criteria. For this study, a purposive sampling was performed to avoid random selected respondents and find suitable farmers to interview (Guest *et al*. 2006; Bryman & Bell 2015). Further, a snowball sampling was performed (Bryman & Bell 2015). By contacting a small amount of people relevant for the subject of the study, these further suggested several interesting participants to contact. Then, contacts were established and ultimately all respondents were set (*ibid*). Originally, around twenty respondents are interviewed for this type of method (Coulter & Zaltman 1995). However, ten respondents were interviewed for this study which goes in line with previous research (Jonasson & Sandlund 2017; Kreutz & Peterson 2020; Blom & Danielsson 2021). Kreutz and Peterson (2020) reached the saturation point, after the sixth interview, which similarly matched with the saturation point of 7 for this study. Data collected from respondents after the seventh interview did not contribute to new insights regarding the topic (Bryman & Bell 2015). However, to ensure validity of the study, three more interviews were conducted which added confirmatory to what previous interviews elicited.

All respondents were active farmers, although some worked partly outside of their farm businesses due to different personal or business-related reasons. Furthermore, all respondents used HVO in their production when the first connection was made. Most of the respondents were customers to a specific fuel distributor which strengthened the use of snowball sampling (Bryman & Bell 2015). The number of Swedish farmers using HVO in their production is limited. Hence, this study included farmers with no regard to their geographical location in Sweden. There were no criteria that covered the question if the respondents used organic or conventional farming methods. Out of the ten respondents, nine of them were men and one woman. Six of the interviews were held physically at the respondents' farms while the last four interviews were performed digitally because of the time limit and long geographical distances to the respondents' farms. Irani (2019) highlights several benefits of performing qualitative interviews digitally, including the possibility to interview respondents not living nearby and still allowing the researcher to visually see the respondents. Further, it provides more flexibility for both researcher and respondents to find interview occasions (*ibid*).

4.2.2 The Zaltman Metaphor Elicitation Technique

Sprung from the marketing research area, the Zaltman Metaphor Elicitation Technique was introduced by Coulter and Zaltman (1995). It is a tool for identifying what mental models drive consumers' behaviour and thinking. The technique aims to elicit underlying values which explain a person's reasoning and meaning about a certain product or service. For this study, the ZMET is used as a tool to elicit the underlying values which explain why farmers use HVO in their productions. By using metaphors as a research tool, the mental models can be mapped. By using metaphors as a research tool, the ZMET provides a deeper understanding for feelings and thoughts that surround the research object (Mauri 2020). Lakoff and Johnson (1980) explain a metaphor as something that describes an understanding and experience of something, in terms of another. Moreover, this leads to the premise that metaphor is central to thought, since it enables the structuring and processing of information by understanding one thing, in terms of another (Zaltman 1997). Hence, metaphors are important for eliciting hidden knowledge and imagination (*ibid*). Christensen and Olson (2002) stress the importance of understanding not solely the cognitive structure, but the actual ideas represented by a mental model. With the aim to strengthen the usage of ZMET to map consumers' mental models, the framework of Coulter and Zaltman (1995) was further developed by Zaltman (1997). There are several theoretical premises that underlie the usage of ZMET (*ibid*). Therefore, before explaining how the technique is executed, some of the assumptions will be presented in the following paragraph to gain a better understanding for why the method is used for this study.

Christensen and Olson (2002) particularly highlight the relevance of two assumptions for using ZMET as a method to identify a person's mental models. Firstly, the content that create mental models for an individual is to a great extent unconscious or tacit (Zaltman 1997). Thus, there is a need for the hidden thoughts to be elicited for the mental models to be identified. By the use of metaphors, such meaning and hidden knowledge can be elicited. Secondly, most communication is non-verbal meaning thoughts are image based. Therefore, language is primarily a tool for expressing or conveying mental models of a person (*ibid*). Hence, as stated by Coulter and Zaltman (1995), thoughts expressed or communicated in words can differ from its original thought. This strengthens the argument for the use of metaphors as a tool since it enables respondents to project and map their mental models through visual images (*ibid*).

This paper aims to shed light on the demand side of biofuel, that is, on the underlying motivational factors for farmers to use HVO in their production. Previously, the ZMET together with MEC as well as the laddering technique have successfully been used in agricultural contexts to elicit the underlying motivational factors and values of farmers who develop their productions (Hansson & Lagerkvist 2015; Hansson & Kokko 2018; Kreutz & Peterson 2020). As abovementioned, the ZMET uses metaphors as a tool during the interviews to elicit the underlying motives of decisions (Zaltman 1997). Respondents are asked to select a set of pictures, used as metaphors, that is related to the chosen subject of the interview (Coulter & Zaltman 1995). Instead of direct questions asked by the interviewers, this methodology allows the respondents to speak and reflect more freely regarding

their choice of pictures (Bryman & Bell 2015; Coulter & Zaltman 1995). Further, Coulter and Zaltman (1995) among other argue that data collected from between 15-20 respondents provides a good basis for further investigation (Christensen & Olson 2002; Hansson & Kokko 2018) However, several studies have proven that a smaller sample can fulfil the purpose as well (Christensen & Olson 2002; Kreutz & Peterson 2020; Blom & Danielsson 2021). For this study, ten respondents were interviewed. In contrast to the original methodology of the ZMET (Coulter & Zaltman 1995; Zaltman 1997), pictures used in this study were chosen by the interviewers. An advantage of providing the farmers a set of pictures before the interview, is that it can facilitate for the farmers (Jonasson & Sandlund 2017). Spring is a busy period for Swedish farmers due to preparations for upcoming harvest season. Therefore, the time the farmers had devoted for the interview was limited. This is confirmed by previous studies (Jonsson & Sandlund 2017; Kreutz & Peterson 2020; Blom & Danielsson 2021).

The ZMET interview process, as presented by Zaltman (1997), originally contains eight steps. Coulter and Zaltman (1995) state that the election of what steps to include in the guided conversation depends on the context of the project and the intended use of data. Kokko and Lagerkvist (2017) dismiss the last four steps; *Metaphor Elaboration, Sensory Images, Vignette* and *Digital Image* with the motivation of previously being difficult for the respondents to grasp and not contributing to the generation of valuable and new information. Further, these steps were by previous research stated as not being essential to the core process, but rather pointed out as supportive and used for validation (Christensen & Olson 2002; Kokko & Lagerkvist 2017; Hansson & Kokko 2018). With support from previous research, this study only included the four first steps from the ZMET which has proven to generate sufficient and the most useful data from respondents (Kokko & Lagerkvist 2017; Hansson & Kokko 2018; Kreutz & Peterson 2020; Blom & Danielsson 2021). Hence, the interview process for this study contained the following steps: *Storytelling, Missed Image, Sorting* and *Construct Elicitation.* During the interviews a reflexive interviewing technique was used in line with Christensen and Olson (2002). Throughout the process' four steps, the interviewers repeatedly made short summarizes of the collected information and restated the respondents' comments to ensure comprehensiveness and to increase the validation of data.

One week prior to commencing the interviews, the respondents were contacted and provided with a set of thirty pictures (see Appendix 4). These pictures had been put together before the interviews with the aim to represent a wide range of motives. Both abstract illustrations and pictures of different agricultural motives as well as other contexts were represented. The respondents were asked to choose 5-7 pictures which they believed symbolised why they use HVO in their production. Further, the pictures were used throughout the interviews as a tool to elicit the underlying motivational factors. The first step, *Storytelling,* commenced with the respondents being asked to present and explain how and why the chosen pictures were related to their decision to use HVO. This step offered the respondents to speak freely about the chosen pictures. Zaltman (1997) argues that this step allows the respondents to tell stories about the content. Each picture represented a metaphor which the

respondents explained through storytelling. The benefit of this first step is that the elicitation of both concepts and thoughts related to the chosen topic is facilitated (*ibid*). In the next step, *Missed Image*, the respondents were asked if they missed any pictures that could add information or be helpful when describing their decision to use HVO. Hence, the risk of missing valuable information or the respondents having issues with gathering the pictures is limited (Coulter & Zaltman 1995). With the aim to highlight and establish major themes relevant for the participant, the next step, *Sorting*, consisted of a sorting task (Zaltman 1997). The respondents were asked to arrange the pictures into piles and provide each with a label and a short description. The last step chosen for this study was *Construct Elicitation*. Here, the laddering technique, described in the next section, was used to identify the attributes, consequences and values that motivate the respondents' decision to use HVO in production. Further, in this step the Kelly Repertory Grid technique (Coulter & Zaltman 1995) was applied additionally to the two beforementioned techniques to efficiently elicit the respondents' underlying thoughts regarding the subject (*ibid*). Three images were randomly picked from the respondents' chosen pictures, and they were further was asked to choose which two are alike and which image differed (Gutman & Reynolds 1988; Coulter & Zaltman 1995). As stated by Hansson and Kokko (2018) this step enabled for the creation of ladders where the most salient reason of the respondents' decisions can be identified.

4.2.3 The laddering technique and Hierarchical Value Map

The laddering technique is commonly used together with the MEC theory (Gutman 1982) and the ZMET (Coulter & Zaltman 1995) to obtain necessary information from the interviewees (Leppard *et al*. 2004). Together, the techniques and theory allow the respondent to explain their values and beliefs regarding a specific subject (Olson & Reynolds 2001). Further, it increases the ability for the researcher to explain a person's thinking during decision making (Modesto Veludo-de-Oliveira *et al.* 2006).

In this study, the laddering technique was used during the last step of ZMET as described by Zaltman (1997). Gutman and Reynolds (1988) define laddering as an in-depth interview technique that involve two actors, the interviewer and the respondent. Further, the aim is to develop an understanding of the respondent's values regarding a certain subject. The main focus when the laddering technique is used in an interview is that focus lays on the person that is interviewed, not on the product. Applied to this study, the product is HVO but the focus when using the laddering technique was to understand what underlying factors motivate the farmer. Traditional laddering, known as soft laddering, gave the respondents the opportunity to freely express his or her thoughts (Modesto Veludo-de-Oliveira *et al*. 2006). In comparison to hard laddering, where the respondents focus on one ladder at a time, soft laddering allows the respondent to jump in between ladders and is suitable for studies with few respondents (Costa *et al*. 2004; Hansson & Lagerkvist 2015). In this study ten respondents were interviewed; therefore, it was motivated to use soft laddering. Grunert and Grunert (1995) highlight that soft laddering implies more excessive data which may facilitate the coding of the interviews.

For this study, we both participated during the interviews and contributed partly as an interviewer, partly as an assistant taking notes. Hence, the validity of the interviews was strengthened since the notes can ensure that the respondent was correctly understood by the interviewers (Bryman & Bell 2015). Additionally, the interviews were recorded, with the respondents' consent, to further secure the validity of the data. Reynolds and Olson (2001) highlight the value of the interviewers' knowledge concerning the laddering technique as well as the MEC theory. The laddering technique is complex and as an interviewer one must understand how to continue the interview in a structured method (Reynolds & Olson 2001; Veludo-de-Oliveira *et al.* 2006). We were aware of this and decreased the risks of not knowing how to continue the interviews by in advance studying the different methods and theories. To reduce the risks of respondents not answering to personal questions and thereby ending the dialogue, some safety measures were proceeded. The respondents were told beforehand that no right or wrong answers existed and that it was the respondent who was the expert since the aim was to understand the world of the respondent (Reynolds & Olson 2001). Further, control of the interviews was assured by us acting as objective, but still attendant, facilitators. If the interview came to a halt, we could share relevant personal information with the respondent or use a third person as example to make the interview less sensitive (Gutman & Reynolds 1988; Reynolds & Olson 2001; Miles & Rowe 2004).

Through questions formulated similar as "Why is this important to you?" the laddering technique worked as a linkage between the different elements of the MEC theory, as typified in Figure 3 (Gutman & Reynolds 1988; Reynolds & Olson 2001). This way, the interviewer can discover important criteria which people think of when making decisions regarding product choices. Further, these criteria create a foundation for later finding deeper values which the consumer hold at more abstract levels (Reynolds & Olson 2001). The abovementioned question enables association networks including attributes (A), consequences (C) and values (V). As the questions become more personal, the interview reaches more abstract levels because of the linkages between concrete attributes (A) and more abstract, previously undefined values (V) (Miles & Rowe 2004). Through organisation of these networks, it appears how products are distinguished from each other and why a person behaves in a certain way (Gutman & Reynolds 1988; Veludo-de-Oliveira *et al*. 2006).

Interviewers	*Why do you use HVO in your farm business?*
Respondent	*Because I want to minimize the farm's CO2 emissions.*
Interviewers	*Why do you want to minimize the CO2 emissions?*
Respondent	*I want to be a part of a sustainable development and agriculture.*
Interviewers	*Why is it important for you to be a part of a sustainable development and agriculture?*
Respondent	*It feels like I contribute to something greater than myself then.*
Interviewers	*Why do you want to be part of something outside of yourself?*
Respondent	*It feels like I belong to something.*

Interviewers	*Why is belonging important for you?*
Respondent	*I don't know!*

Figure 3. Example of interview section when laddering technique is used (own work)

Once the interviews were completed, a content analysis was done. A content analysis contains key words which represent the main elements from the interviews (Gutman & Reynolds 1988). This is a common step when the MEC theory is applied together with the ZMET as well as the laddering technique. The elements were mapped together and sorted in master codes, see Appendix 2. Then, the master codes were transformed into numerical values and described in an implication matrix. The implication matrix illustrated different relations and the number of times an element was brought up by the respondents (Gutman & Reynold 1988; Reynolds & Olson 2001). This step was conducted through the software program LadderUX. Costa *et al*. (2004) highlight the importance of this stage since it is here that the qualitative data is quantified. The third step in the analysis process was to create the Hierarchical Value Map (HVM), also accomplished via LadderUX, to ensure validity and accomplish an objective approach (Costa *et al*. 2004). The software program LadderUX has been applied in previous agricultural research that analysed farmers' behaviours and values (Kreutz & Peterson 2020; Capetillo Hernández 2020; Blom & Danielsson 2021), which motivates why it was used for this study as well.

The HVM presents aggregated data divided into hierarchical levels based on the implication matrix. It is the linkages between the elements in the HVM that are of importance. The more times an element was mentioned by the respondents, the thicker the line linking the elements together is (Gutman & Reynolds 1988). Moreover, the links of elements in the HVM are called chains in comparison to in earlier stages of the analysis process when the linkages are known as ladders. Further, to ensure that the HVM is used correctly, a cut-off value is used. The cut-off value is applied to determine how many times an element must be mentioned, and linked to, to be included in the HVM. There is no common agreement regarding the most optimal cut-off value. However, Gutman and Reynolds (1988) argue that for a study with 50-60 respondents, a good cut-off value is 3-5. Furthermore, one can create several HVMs with different cut-off values to see which one fits the data the best. For this study, several HVMs with different cut-off values were produced since it led to better evaluation of what cut-off value that was most suitable to fit to our data well (Gutman & Reynolds 1988). Then, the final cut-off value of 2 was decided as suitable for this study since it includes few respondents. By setting the cut-off value to 2, it became clear what the major motivational factors as to why farmers use HVO in their productions were.

4.3 Quality criteria in research

Reliability and validity are principal criteria to have in mind when conducting research (Bryman & Bell 2015). The criteria have prior to this study mainly been used in quantitative research (*ibid*). However, Golafshani (2015) argue that the

concepts are used at an increased rate in qualitative studies and therefore, this study uses the criteria to further contribute to existing literature. Reliability is used to measure if the result of a study is replicable in another context, or not (Bryman & Bell 2015). This study uses an interview technique together with other concepts which formerly have been applied in agricultural contexts (Hansson & Kokko 2018; Kreutz & Peterson 2020; Blom & Danielsson 2021). Hence, the applicability of the same method in previous studies strengthens the reliability of the chosen method. Further, we had fixed roles throughout all interviews, as interviewee respectively as a writer, which further can secure the reliability of the study (Brinkmann & Kvale 2015).

Validity measures how well the study actually measures what it is purposed to investigate (Brinkmann & Kvale 2015; Bryman & Bell 2015). For this study, the same interview method and technique is used for all respondents which verify the validity of the study. Further, the use of ZMET ensured that the research matter (the reason why the farmers use HVO) was constantly held in focus. Hence, it is solely the answers of the respondents that differ. No leading questions were asked during the interviews. Thus, assurance that the respondents' answers were not influenced by us was made. Thereby the result of this study is assured to be based on words expressed by the respondents themselves.

4.4 Ethics in research

When a qualitative study is conducted the researchers should be aware of ethical matters associated to the study (Bryman & Bell 2015). Otherwise, the quality and outcome of the study may be affected (Brinkmann & Kvale 2015). Additionally, when interviews are used in qualitative studies it is even more important to acknowledge the ethical issues because of the complexity of research in private lives (Brinkmann & Kvale 2015). Four guidelines were used as support to ensure that ethical matters were fulfilled: informed consent, confidentiality, consequences, and the role of the researcher (*ibid*).

When first contacted, intended respondents were briefed about the aim and research question for this study as well as its main features. This ensured that the respondents were well informed about the study and could therefore make a well-founded decision regarding their participation (Brinkmann & Kvale 2015; Bryman & Bell 2015). Before the interviews, the respondents were informed that their contributions to the study were anonymous, and they were asked to approve if the interview could be recorded. This was done to ensure confidentiality and protection of the respondents' private lives (Brinkmann & Kvale 2015). Further, Bryman and Bell (2015) state that researchers have no right to disrespect a respondent's privacy. Therefore, the respondents for this study were informed about that the recording and notes taken during interviews were solely for the purpose of the study and if any questions were perceived as sensitive, these could be answered by saying "I do not know" (Brinkmann & Kvale 2015). Lastly, it is of importance for the researchers to position themselves in a natural role and stay objective. If not, the results may be biased and thereby the study can decrease in validity (*ibid*).

5. Results

5.1 Description of respondents

Ten farmers participated in this study; a sample proven to be sufficient by previous researchers that used the same method (Jonsson & Sandlund 2017; Kreutz & Peterson 2020; Blom & Danielsson 2021). To fulfil the aim of this study, all farmers that participated used HVO in their productions. Nevertheless, some mentioned that they had previously used RME but changed to HVO due to the higher price on RME. Most farmers expressed a concern regarding the increased price and future price development on HVO. Furthermore, some of the farmers mentioned that they were uncertain if they, due to economic factors, would be able to continue to use HVO in their agricultural machines.

As shown in the descriptive statistics (Table 2), most of the farmers were males. One woman took part in the study, since the snowball technique (Bryman & Bell 2015) used did not generate any more. Further, there was a variety regarding the focus of production with crop production, a diversity of animal productions and forestry. A small majority of the farmers were organic (Table 2). Table 2 also illustrates the mean value of how many years the farmers have used HVO.

Table 2. Descriptive statistics of the respondents (own work)

Variable	**Value**
Number of men	9
Number of women	1
Number of organic farms	6
Number of conventional farms	4
Years of using HVO (mean value)	6,2

Further, the farm size, expressed in hectares, varied among the farmers and the different sizes are categorized, as presented below in Table 3:

Table 3. Categorisation of size of respondents' farms (own work)

Size of farm, expressed in hectares	**Number of respondents**
$0 \geq 50$	3
$51 \geq 200$	2

$201 \geq 400$	4
$401 \leq \infty$	2

The interviews were performed both physically at the farmers' farms and digitally. When performing digital interviews, there were some delays due to the pictures having to be presented through PowerPoints. However, this gave time for the farmers to describe their productions.

5.2 Empirical findings

5.2.1 Storytelling

During the first phase of the interviews, the farmers were told to address what pictures they had chosen, why these were chosen and how they could help the farmers to describe their choice to use HVO in their productions. All farmers chose 5-7 pictures out of the total sample that consisted of 30 pictures (Appendix 4). Most of the pictures chosen by the farmers were connected to future generations, care for the environment, biodiversity, decision making and less impact on the environment. Among all pictures, two were consistently chosen by eight out of ten respondents, one picture connected to future generations whereas the other showed the care for the planet and the environment.

Three of ten farmers chose a picture of the stock market and a connection to economic incentives. No farmer expressed that economic incentives were motivations for using HVO. However, the vast majority mentioned how the profitability of their farming business enabled them to afford to use HVO. Further, some farmers expressed concerns regarding the price development of HVO and an uncertainty regarding if the increased costs would force them go back to use fossil diesel. Many of the farmers had used HVO for several years (see Table 2) and during this phase some mentioned that this early adoption meant that they were not able to benefit from some of the financial aid and compensation that is carried out to farmers who do the transition to HVO today.

Five pictures were never selected by any of the farmers, out of which the majority illustrated more abstract motives not connected to agricultural contexts. Further, pictures of utopian and dystopian scenarios were never mentioned to be associated with the choice of using HVO. The storytelling phase ended when all the chosen pictures were reviewed and freely talked about by the farmers. This step led to the creation of entry points, in which the laddering procedure later began, and subsequently the respondents were asked for missed images.

5.2.2 Missed images

After the first step, where the farmers presented their chosen pictures, they were asked if they missed any pictures. These pictures would have, in that case, further simplified the choices of pictures for them. Almost all farmers answered that the given set of 30 pictures was enough to describe why they use HVO in production.

Two farmers replied that a picture describing the simplicity of converting to and using HVO as well as the production itself of HVO could have been helpful. A third farmer asked for a picture which could have represented a more religious and holistic view of life. The farmer argued that the choice of using HVO is rather a personal opinion.

5.2.3 Sorting images

During the *Sorting task* phase, the farmers were asked to sort the chosen pictures in piles, based on if they had something in common. The piles were then described with different words depending on the pictures. Some farmers repeated words that had been mentioned in the first step, the *Storytelling* phase, to describe the different clusters. Several times the farmers chose to group only one picture in a pile because they wanted to include many descriptions as to why they chose HVO as fuel in their productions.

As example, one farmer grouped a picture showing a flowering field with a picture of several painted plants together, describing them as biodiversity. Several farmers used the notion "Generation" to describe different constellations of pictures, all showing human activity in some way. Climate was a common concept to describe piles representing pictures of the earth or pictures showing fields and plants.

5.2.4 Construct elicitation

For the last step the farmers were given four sets of three randomly chosen pictures and asked to sort them into two piles, whereas two of the pictures represented something commonly and the third picture differentiated from the other two. In this step the laddering technique was applied. By forcing the farmers to further explore the values connected to each of the concepts presented through the images, ladders were created. This application of technique admitted attributes, consequences and values connected to the farmers' thoughts regarding the decision to use HVO in production

When asked to describe what the piles of pictures were representing, the farmers' different answers were returned with several more questions starting with "*Why…*". This procedure was repeated until the farmers responded with "*I do not know*" or could not explain their thoughts to any further extent. The ladders produced in this step constituted the results of this study as well as a foundation for the analysis. The attributes, consequences and values were developed through master codes. These were sorted in ladders via LadderUX, where implication matrices and hierarchical value maps were created.

With data conducted from the interviews, the coding resulted in a total amount of 89 ladders. Further, the ladders consisted of 47 elements, specifically 14 attributes, 22 consequences and 11 values. In LadderUX, two different HVMs were created, one where the complete dataset was illustrated (see Appendix 3), and the second using a cut-off value of 2. For the original HVM, the total amount of links was 141 of which 114 were direct links and 27 were indirect links. In order to receive an HVM that was easy to comprehend, a cut-off value of 2 (2/2/2) was used, in

accordance with guidelines of Leppard *et al.* (2004). This HVM (see Figure 4) was used for the analysis of the present study and presents 89 ladders consisting of 23 different elements, namely eight attributes, ten consequences and five values. Hence, with ten farmers there was an average of 8.9 ladders per farmer, with an average of 2.28 elements per ladder. The HVM contains a total of 49 links, whereof 43 are direct and 6 are indirect. The amount of link corresponds to 34.75% of the links in the total data set. Therefore, the HVM presented in Figure 4 represents the data mentioned the most times by the respondents. Further, thicker lines in the HVM describe a stronger relation between the elements. The number of times an element was highlighted during the interviews is included in Figure 4 as well as in the implication matrix (Appendix 1).

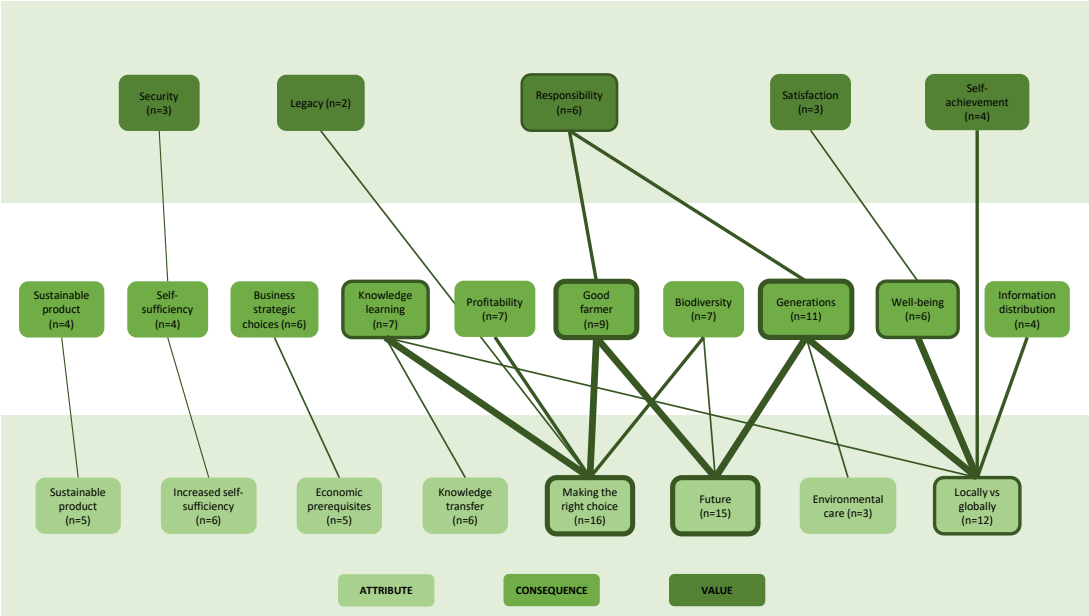

Figure 4. Hierarchical Value Map with cut-off values 2. Thicker arrows argue for stronger connections between the elements (own work)

Attributes

As illustrated in Figure 4, there were eight attributes included in the HVM with cut-off value 2. These were "Sustainable product", "Increased self-sufficiency", "Economic prerequisites", "Knowledge transfer", "Making the right choice", "Future", "Environmental care" and "Locally vs. globally". The more times an attribute was mentioned by the respondents, the more important it was for them.

Above presented, Figure 4 shows that the attributes "Making the right choice", "Future" and "Locally vs globally" were most important for the farmers, mentioned 16, 15 respectively 12 times during the interviews. Several farmers argued that choosing HVO over fossil fuel was the right choice to do. This way one can, as one farmer expressed, be an inspiration for other farmers. Further, a majority of the farmers did not want to hand over a "bad planet" to future generations and give them bad conditions to live on the planet.

Some farmers argued that the reason for why they can use HVO in production is because of the profitability in other parts of their agricultural companies. Unless the profit margin would not have been what it was for these specific farmers, the choice to use HVO would be harder to justify. Hence, the attribute "Economic prerequisites" was included in the HVM.

Consequences

From every attribute included in the HVM, there was at least one linkage to a consequence. In total, ten consequences were included in the HVM, namely "Sustainable product", "Self-sufficiency", "Business strategic choices", "Knowledge learning", "Profitability", "Good farmer", "Biodiversity", "Generations", "Well-being" and "Information distribution". "Generations" was the consequence mentioned most frequently, eleven times. Seven farmers discussed the importance of giving future generations the same opportunities that themselves have been offered during their lifetimes. Repeatedly, the farmers talked about their own children and grandchildren to describe why they thought HVO was the right choice. Further, some farmers expressed the importance of enable their children to do activities that are valuable for themselves today. For several of the farmers, it was important to acknowledge that every local impact will affect people on a global level. Therefore, in order to secure a safe society for future generations, it is needed to be aware of one's activities today.

The consequence "Good farmer" was highlighted nine times and linked to the attributes "Future" and "Making the right choice". According to the farmers, this consequence is connected to different benefits of using HVO. One of the farmers discussed that it could lead to less climate impact while another farmer highlighted that it is important to take advantage of resources that are located and produced in neighbouring countries to Sweden, as Finland. According to the interviewed farmers, other perceived benefits from the use of HVO were less soil compaction and more efficient animal- and crop production.

The consequences "Knowledge learning", mentioned seven times, and "Information distribution", mentioned four times, both included concepts connected to knowledge. Several of the farmers believed that by informing the general public about why HVO is a good choice, both oneself as well as other people obtain and increase knowledge in the topic. By obtaining new knowledge, the farmers could understand relationships within their businesses as well as make better, well-founded decisions.

Values

With the cut-off level of 2, the HVM displayed a total of five values. These values reflect the underlying motivational factors as to why the farmers use HVO in their productions. Furthermore, the main values elicited are: "Legacy", "Responsibility", "Satisfaction", "Security" and "Self-achievement".

Mentioned six times by the respondents, "Responsibility" was the most prominent value. The value was linked to the consequences "Generations" and "Good farmer". When discussing future generations and their opportunities, the farmers talked

mainly about their own family and children and the wish for them to have a good life in the future. Some mentioned that it did not matter if it was a family member taking over the farming business, rather that anyone who did would have the same prerequisites and opportunities to use and cultivate the land that they have had. "Responsibility" was therefore discussed in terms of assuring future generations the same prerequisites to continue the agricultural business. Meanwhile, the farmers talked about being a good farmer in sense of using what they perceived as the most sustainable production methods, namely using HVO. Hence, by using HVO the farmers recognised responsibility. Additionally, the farmers argued that when making decisions, based on what they thought was the best choice, they supported a development for a good future. Through reduction of several agricultural inputs, efficient cultivation methods and deliveries of good products, this development could be reached. By investing in time and workload at the farms, the value "Responsibility" could be achieved.

"Self-achievement" was an element emphasised four times by the farmers. The value was mentioned, through its indirect linkages, in relation to consequences such as "Well-being", "Future" and "Information distribution". One farmer discussed the importance of giving and getting love from the nearby surroundings. Surroundings described as a small universe with only the closest relatives included, could be created if this social action occurred. Through education and information regarding the benefits of HVO, the risks of being a negative influence on the global development decreased. Ergo, through these performances the farmers could achieve the value "Self-achievement".

Furthermore, the value "Security" was highlighted three times by the farmers. Closely related to the value were notions regarding self-sufficiency. Being self-sufficient was equated to securing a good foundation for one's own family and therefrom create security. Two farmers talked about the possibilities of a future domestic production of HVO, and that domestic production and self-sufficiency are of high importance in order to stand strong if crises would occur. As example the farmer mentioned wars and trade barriers between countries or institutions. Furthermore, by securing a domestic production of agricultural inputs the risks of negotiating with non-democratic countries decrease which was important according to the farmers. These arguments lead to the value "Security".

The respondents mentioned the value "Satisfaction" three times and it was derived from the consequence "Well Being" and the attribute "Locally vs. Globally". Several of the farmers mentioned that they feel satisfied about their choice to use HVO. Some of the farmers expressed that when caring for the environment on a community and global level, they feel good about themselves, sleep well at night and get acknowledgement from friends and family. One farmer mentioned the importance of how small actions can make a difference worldwide. This difference being the use of HVO, leading to a feeling of satisfaction for the farmer.

Lastly, "Legacy" was emerged from consequences as "Well-being" and "Generations" and had several indirect links with the attribute "Making the right choice" (Appendix 1). For several of the farmers, it was important to take care and manage their productions and land for future generations. One farmer discussed that

everyone has a reason for being and living on this planet, and for this farmer it was to take care of what was given to the farmer.

Prominent ladders

During the interviews, several elements were repeatedly mentioned. This resulted in four ladders being more prominent than others and having strongest relations in the HVM compared to other ladders. These are presented in Figure 6, see below.

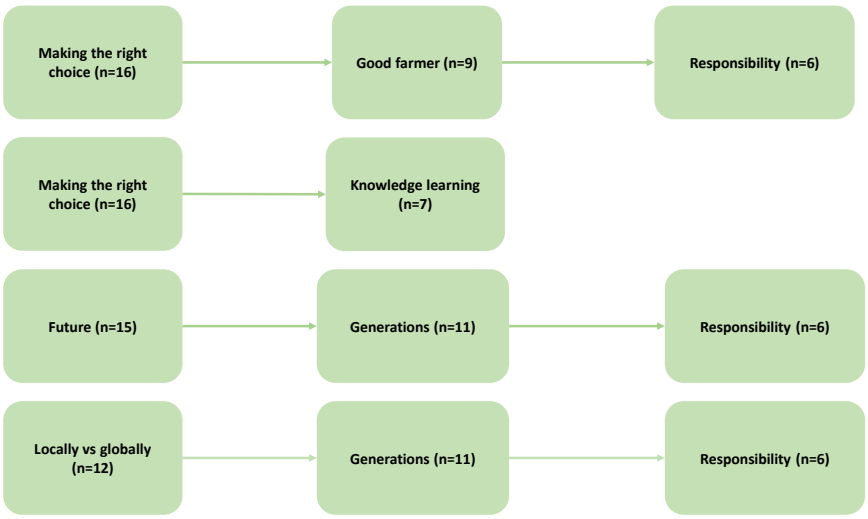

Figure 5. Most prominent ladders (own work based on the HVM with cut-off value 2)

None of the most prominent ladders include elements related to economic aspects. Instead, they all revolve around social perspectives and integration of other people who are in direct and indirect contact with the farmers. The farmers achieve the value "Responsibility" when they feel that they can provide future generations the right prerequisites. To do so, it is of importance to make the right choice in forms of taking care of the planet both locally as well as globally.

6. Discussion and conclusion

The present study was designed to identify the underlying motivational factors as to why farmers decide to use HVO in their productions. Hence, the following research question was formulated.

"What are the motivational factors as to why Swedish farmers use HVO in their productions?".

The findings suggest that the most prominent value behind the decision is "Responsibility". This is followed by the values "Self- achievement", "Security", "Satisfaction" and "Legacy". The study is delimited to only interview farmers who use HVO in their productions. In comparison to the use of fossil fuel, the decision to use HVO is in this study considered to be a sustainable transition which farmers decide to implement in their businesses. As stated in the literature review, farmers consider both pecuniary and non-pecuniary values when making decisions. This study suggests that the motivational factors as to why the farmers use HVO is mainly based on non-pecuniary factors. Yet, a vast majority of the farmers made comments about profitability, with regard to that it is a prerequisite rather than a motivation as to why they use HVO. Hence, the findings of this study can be used to further, in accordance with Weersink and Fulton (2020), argue that new mental models are necessary to better understand why farmers adopt sustainable transitions. These updated mental models can be used by policy makers to develop new policy instruments as well as contribute to a development of traditional economic theory (Debertin 2012). Several agricultural models suggest that farmers make decisions based on the expected utility level, which derives from economic aspects (Debertin 2012; Howley *et al.* 2015). To be able to fully use these models there is a need to incorporate variables similar to abovementioned values. Consequently, the findings of this study support the importance of understanding underlying values and motivational factors when investigating farmers' decision making (Gasson 1973; Lunneryd & Öhlmér 2009; Hansen & Greve 2014; Hansson & Lagerkvist 2015; Hansson & Kokko 2018; Mellon-Bedi *et al.* 2020).

6.1 Critical reflection

The findings of this study can contribute to fill a gap in current literature regarding motivational factors in agriculture, in the context of farmers who use HVO. The techniques used for this study have sparingly been used within this field of research, and never in relation to an aim and context similar to this study. We argue that the specific techniques allowed the farmers to go deeper in their reasoning.

Furthermore, performing both digital and physical interviews with the farmers could have an impact on the results of the study. It was harder to conduct the interviews digitally due to miscommunications as well as technical problems. However, as aforementioned, it allowed for more respondents to be included, which increase the validity of the study (Irini 2019). In addition, previous studies describe that digital interviews do not affect the results (Kreutz & Peterson 2020; Blom & Danielsson 2021).

When the HVM was created, it was necessary to decide level of the cut-off value (Gutman 1982). The construction of the study's HVM would appear to include a considerable amount of subjectivity, which could have an impact on the validation and comparison across studies. To increase the transparency in this study, the original HVM without cut-off values is presented in Appendix 3. The decision of cut-off value included a thorough comparison of the raw data from the interviews. Some elements were only mentioned one time by the farmers; hence we argue that the chosen cut-off value of 2 presents an informative and interpretable HVM.

For this study, ten farmers participated in the interviews and thereby created the foundation of the results and discussion. The sample can be interpreted as small and therefore, caution needed to be taken when the study's discussion was conducted. Zaltman and Coulter (1995) argue that around 20 participants is optimal when the ZMET is used for a qualitative study. However, previous research studying agricultural contexts have included around ten respondents and achieved to fulfil the aims of the studies (Jonsson & Sandlund 2017; Kreutz & Peterson 2020; Blom & Danielsson 2021). In addition, Christensen and Olson (2002) argue that fifteen respondents were far enough to interview in their study, which strengthen the argument that ten farmers were sufficient to create a basis for the analysis. Furthermore, Swedish Energy Agency (2021) states that 2.3 percent of the agricultural machines in Sweden are run by biodiesel. Since several biofuel options exist, one can argue that a smaller share is dedicated to HVO. Therefore, even though the sample of this study may not be representative for the specific context, we argue that the number of respondents was enough to conclude the findings. As aforementioned, we experienced that the saturation point, where no new knowledge was added to the study's result, was reached when the seventh interview was conducted. Bryman and Bell (2015) raise some arguments regarding issues with the generalization of results conducted from qualitative research such as is it is difficult to apply the results on a population. Meanwhile, as abovementioned, the ZMET allows for an in-depth data collection which can be helpful for further development of the theory and concepts used in this study's conceptual framework.

The interviews were performed in Swedish to facilitate for both researchers and the respondents, since the main language for all involved is Swedish. When later coding and analysing the results, this was done in English. Hence, a translation to English was performed and concerns with subjectivity should be considered. To prevent subjectivity from happening, we discussed thoroughly the options for different translations to ensure that most well-fitted translations were obtained, in accordance with Bryman and Bell (2015). Further, we aimed for a high level of transparency all through the study to minimize the risk of subjectivity. This was done by carefully following the suggested options in applied techniques and theories, including raw

data as appendixes to the study and informing the farmers about how their answers were to be used.

6.2 Discussion of method

By using the ZMET together with the laddering technique during the interviews, it was possible to elicit the farmers' motivational factors as to why they use HVO. Several elements were described as important in the reasoning process, explaining the farmers' choice to use HVO as well as why farmers perform sustainable transitions. The results generated from this study can be considered as unique since the chosen approach and methods provide new perspectives to the understanding of why farmers use HVO. This choice of method was shown to generate useful and rich data, mainly obtained from the first phase *Storytelling* and the last phase *Construct Elicitation.* This finding supports previous research that suggested that these steps could be considered to generate the most useful information (Christensen & Olson 2002; Kokko & Lagerkvist 2017; Hansson & Kokko 2018; Kreutz & Peterson 2020). The first step of the interviews, the *Storytelling* phase, allowed for the farmers to talk freely about the chosen pictures and offered an initial understanding of the overall motivational factors as to why they use HVO. Not constraining the farmers into specific answer categories, but rather letting them control which aspects to highlight, increased the possibilities for a more in-depth collection of information. Further, the information elicited in this phase provided an initial understanding for the underlying motivations as to why the farmers use HVO, and how the different aspects were linked to each other. An additional advantage of this method that enables for a deeper understanding, in comparison to other qualitative methods, was found in the fourth step where the laddering technique was applied. By helping the farmers to reach deeper in their reasoning process, the laddering phase elicited information about previously hidden information regarding the choice to use HVO.

Another aspect highlighted by previous research as beneficial with the use of ZMET is its ability to reach deeper within the aim of the study by constantly keeping the research matter in focus (Kokko & Lagerkvist 2017). This is a practical strength with the method derived from the use of images since it helps both the respondents as well as the interviewer to remain focus on the topic. Hence, *Storytelling* and *Construct Elicitation*, used together with the laddering technique, generated sufficiently rich and deep information regarding the farmers' thoughts and feelings connected to their use of HVO. This statement corresponds to the findings made by Kokko and Lagerkvist (2017) and could therefore be suggested as targeting phases for future research. The remaining steps *Missed Image* and *Sorting* were more of a confirmatory and supportive character, rather than providing new information or additional perspectives. Still, the steps were considered useful for the farmers since they allowed for a reflection regarding the question why they use HVO.

Even though all the farmers were unfamiliar with the task, they engaged in the interview process with great curiosity and a positive attitude. This supports Coulter and Zaltman's (1995) observation about respondents being dedicated to the task,

despite it was perceived as unfamiliar. Further, some of the farmers expressed that the use of images, although it was unfamiliar, helped them express their thoughts and challenged them to verbalise their feelings throughout the interviews. This supports another strength with using ZMET, mentioned by Kokko and Lagerkvist (2017), namely the importance of the fact that peoples' thinking is of visual nature and by using images deeper understandings can be obtained.

6.3 Discussion of results

As presented above, all values derived from the HVM were connected to non-pecuniary aspects. Hence, this shows that farmers who use HVO do not value profitability and other pecuniary aspects as motivational factors, instead values connected to behavioural aspects have the greatest influences, which goes in line with earlier research (Hansen & Greve 2014; Hansson & Lagerkvist 2015; Hansson & Kokko 2018; Mellon-Bedi *et al.* 2020). Meanwhile, other studies highlight that farmers are mainly driven by pecuniary factors and make decisions based on their expected utility-level (Debertin 2012; Howley *et al*. 2015). Even though the element "Profitability" was described in this study's HVM, it is clear that behavioural values such as "Self-achievement" or "Satisfaction" are of higher importance for these farmers. Further, the most prominent ladders (see figure 5) do not contain any economic elements. Instead, three of four end states for the prominent ladders were "Responsibility", derived from the consequence "Generation". These findings, in accordance with Schwartz (2012), describe that farmers' underlying motivational factors and values are founded in values such as "Universalism" and "Benevolence" (see Table 1). The two values contradict in some perspectives since they focus on taking care of and increase welfare for society respectively for the closest related (Schwartz & Boehnke 2004). However, several farmers highlighted that it is because of future generations, meaning both one's own family and on a societal level, that they choose to use HVO. Mellon-Bedi *et al.* (2020) argue that social influences are important in decisions similar to the one this study focuses on. Hence, the abovementioned values developed by Schwartz (2012), can be connected to the value "Responsibility" which was derived from this study. Thus, the farmers are inclined to enrich the living as well as the environment surrounding people other than themselves.

Schwartz's (2012) definition of values can be applied further in relation to the results of this study. Elements such as "Self-sufficiency", "Security" and "Well-being" were highlighted numerous times by the farmers, which goes in line with Schwartz's value "Security" (2012). The farmers' reasoning was built on the possibility of HVO being produced domestically. Further, the use of HVO could then increase the chances of a more developed labour market in Sweden (Karlsson Potter *et al*. 2020; Karlsson Potter *et al*. 2021). Additionally, some farmers reasoned that if international crisis were to occur or Swedish food supplies decreased, it would be crucial to be able to domestically produce HVO. Then, the risk of not having agricultural inputs available would decrease and farmers' productions would be less vulnerable. Hardaker *et al.* (2015) argue that farmers make decisions based on different degrees of risk as well as individual values (Hansson & Kokko

2018; Weersink & Fulton 2020). This can indicate that a strong domestic food- and supply chain increase the farmers' feeling of being safe together with their families, which enables for the farmers to achieve well-being. Further, Schwartz (2012) argues that national security and stability are relevant connections to the value "Security", which is confirmed through the results of this study. In 2022, the Swedish Government announced that an inquiry regarding the Swedish self-sufficiency and food security is to begin (Ministry of Enterprise and Innovation 2022). Due to the unstable situation in the world, the Swedish Government argues that it is necessary to strengthen the country's food production and -security. Based on the results from this study regarding the value "Security", a domestic production of HVO may contribute positively to the domestic food production and -security in Sweden, which several farmers highlighted.

Schwartz (2012:5) describes the central motivational goal achievement as "personal success through demonstrating competence according to social standards". This goes in line with what several farmers mentioned connected to the value "Self-achievement". Further, by sharing knowledge and experiences about the benefits with HVO, they perceived that they could possibly be a good influence on society and thereby reach "Self-achievement". When discussions regarding legacy occurred during the interviews, several farmers related the notion to having a respect for the previous as well as future generations. Further, some farmers expressed that it was important for them to take care of the land they owned which they thought were accomplished by using HVO. This suggests that the values "Universalism" and "Tradition", developed by Schwartz (2012), once again can be used in relation to the findings of this study. Lastly, the value "Stimulation" (Schwartz 2012) is in close relation to the value "Satisfaction", derived from the HVM. Numerous farmers mentioned that it was exiting to use HVO in their productions. Some farmers seek a varied life including both challenges and opportunities, which was achieved by using HVO. Even though the farmers were aware of environmental problems that stand ahead, they were optimistic about how their choices could contribute to a better development, which goes in line with the value "Stimulation" (*ibid*).

The consequences "Profitability" and "Business strategic choices" were mentioned seven respectively six times. Farmers who use HVO are aware of the economic prerequisites which enables the achievement of values connected to behavioural aspects. Nonetheless, a vast majority of the farmers did not mention profitability as a motivation behind the decision to use HVO, but rather as a condition in order to achieve a well-functioning business and to afford to buy the fuel. The elements mentioned above can be described as instrumental values (Gutman 1982) even though they, according to the HVM of this study, are not presented as values but rather as consequences. Meanwhile, in order for the farmers to achieve terminal values such as "Security" and "Self-achievement", instrumental values are used as means to reach these goals. Therefore, as in line with Hansen and Greve (2014), elements as "Profitability" are necessary for farmers to accomplish their terminal goals. Renewable fuel is more expensive than fossil fuel (Fossil Free Sweden 2020), concurrently other agricultural inputs are increasing in price (LRF 2021), which imply that farmers must run a well-functioning business to be able to use HVO in

their productions. Terminal values are prioritised before instrumental values by the farmers, which corresponds with the study by Hansen and Greve (2014). Consequently, as previously highlighted, profitability is not the farmers' only motivation when decision regarding how to run their businesses are made.

As aforementioned, this study suggests that new mental models are needed to better understand why farmers adopt sustainable transitions. The findings strengthen what previous research within similar agricultural contexts have proven, that not only pecuniary factors matter when farmers make decisions (Hansen & Greve 2014; Hansson & Lagerkvist 2015; Kreutz & Peterson 2020). It is necessary to develop mental models where farmers' values and underlying motivational factors are included, previously highlighted by Hansson and Kokko (2018). This, in turn, indicates that the idea of farmers being driven by profit maximisation (Debertin 2012) should be further developed and include behavioural factors as well. Additionally, the findings and discussion for this study do not support the idea that profit maximisation can be equated with utility (*ibid*). Rather, the findings suggest that there are more values than pecuniary values in a utility-function and that farmers also are motivated by non-pecuniary factors. This can be beneficial for policy makers and stakeholders to be aware of, something which will be discussed in the following paragraph.

The results from this study imply that elements such as "Profitability" are instrumental and hence, not prioritised as high as terminal values. This can give an implication for policy makers how policies and regulations should be formed. The investigation about fossil independent agriculture, ordered by the Swedish Government (SOU 2021:67 2021), has declared several policy instruments in order to reduce the fossil use in Swedish agriculture. Among these, one suggestion is to establish a bio bonus for farmers who use HVO or other biofuels in their productions to reduce the price difference between fossil fuel and biofuel (*ibid*). The results from this study, that the cost issue of HVO is of importance for farmers, strengthen the policy instrument suggested through the investigation about fossil independent agriculture. Meanwhile, the findings of this study show arguments that it is necessary for policy makers and lobbyists to acknowledge the non-pecuniary aspects as well. Farmers do not make decisions solely on the profitability of their agricultural businesses. Due to the higher costs of using HVO in Sweden today (SOU 2021:67 2021; Tanka 2022), it could be argued that the decision as to why the farmers use HVO in their productions are affected by a trade-off between profitability and the sustainability matter to a certain degree. The motivational factors as to why they chose a sustainable fuel such as HVO, are valued higher than ensuring a higher profitability in their agricultural businesses. Although, depending on the economic prerequisites for each of the farmers' businesses, the threshold for the costs of HVO is individual. Further, an economic limit exists where the price of HVO is no longer affordable. There could be several ways to make the economic threshold for using HVO lower, which could enable for more farmers to use HVO without it being a significant cost affecting the overall profitability of a business. Apart from policy instruments, stakeholders can use the results from this study to increase the knowledge among farmers, organisations, and consumers.

6.4 Future research

There is abundant room for further research in the study field of biofuel in relation to economics and management. As mentioned in the section above, this study's results point to that a willingness exists among farmers to buy HVO in order to be sustainable. Additional research can study if a similar willingness to pay for these fossil-free products exists among consumers, if the market can adopt these types of products or if it is necessary to regulate the market through policy instruments. Moreover, several of the interviewed farmers highlighted that it was difficult to sell their products with a fossil-free label since that would require a life-cycle analysis on all inputs. Hence, how this labelling as well as categorization of fossil-free products should be realised is another suggestion for further investigation. Additionally, it can be of interest for future research to investigate whether new business models are needed for fossil-free products to be introduced on the market and how the production costs should be distributed among actors. This study points to that for farmers to fulfil end goals by using HVO, and thereby contribute to a sustainable food production, several stakeholders must cooperate. Today, HVO is more expensive than fossil fuel and therefore it is interesting to study how the extra costs that comes with the decision to use HVO could be distributed among actors in the food value chain.

As complementary research to the results obtained from present study, an investigation of the underlying motivational factors as to why farmers chose not to use biofuel are suggested. This could add to the understanding of what motivational factors, as well as attitudes and preconceived notions, farmers have regarding the use of HVO. The results from present study, together with suggested research, can be of use for policy makers and advisers. To further implement the transition towards more sustainable agricultural production methods in line with for example, the Swedish food strategy (Government Offices of Sweden 2016), the suggested research could be used.

6.5 Conclusion

The present study aims to elicit and determine the underlying motivational factors as to why farmers use HVO in their productions. The method used for generating the results have previously been applied with successful results when investigating motivational factors in agricultural contexts (Hansson & Kokko 2018; Kreutz & Peterson 2020; Blom & Danielsson 2021).

The results of this study show that the most prominent values describing the interviewed farmers' motivational factors and values as to why they use HVO are; "Responsibility", "Self-achievement", "Security", "Satisfaction" and "Legacy". These can be described as terminal values, the end goals which the interviewed farmers want to achieve during their lifetimes. Even though farmers partly make decisions to increase economic welfare of the business (Debertin 2012) this study is, in accordance with recent studies, indicating that non-pecuniary factors matter when farmers make decisions (Hansen & Greve 2014; Hansson & Lagerkvist 2015;

Howley *et al*. 2015; Kreutz & Peterson 2020; Owusu-Sekyere *et al.* 2021). Hence, in accordance with Howley *et al.* (2014) we argue that it is of importance to include non-pecuniary values in economic models. This statement, along with the findings of this study, further provides arguments for the creation of new mental models including behavioural aspects when discussing decision making in an agricultural context.

Today, HVO is more expensive than fossil fuel, with regard to both price and tax-refunds. Hence, profitability is not mentioned as a motivational factor as to why the farmers decided to use HVO, but rather as a needed prerequisite in order to use HVO. The results from this study suggest that pecuniary values, such as profitability, are not motivational elements in the context of using HVO. Instead, it functions as an instrumental value that enable for the decision to use the more expensive and, as the farmers expressed, sustainable alternative.

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Acknowledgements

We wish to thank our supervisor Helena Hansson at the Department of Economics at the Swedish University of Agricultural Sciences for guiding us through the process of writing this thesis. Your great knowledge, valuable inputs and support have been invaluable. We would also like to express our gratitude to all the farmers for Your contribution and positive attitudes. It was a pleasure meeting You all and Your answers were fundamental for conducting this study. Lastly we would like to thank our opponent for valuable feedback.

Appendix 1 Implication Matrix cut-off value 2

IMPLICATION MATRIX	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	
1 Future generations																			1|0																	1|0												2|0
2 Sustainable product															1|0			2|0						1|0									1|0								0|1							5|1
3 Increased self-sufficiency																1|0				2|0	1|0				1|0											1|0	0|2				0|1							6|3
4 Economic prerequisites															2|0						1|0	1|0											1|0					0|1										5|1
5 Locally vs Globally															1|0	2|0		1|0	1|0		1|0						2|0								2|0	2|0		0|2			0|1							12|3
6 Biodiversity													1|0						1|0		1|0						1|0		1|0					1|0					0|1	0|1			0|1					6|3
7 Climate																										1|0																		0|1				1|1
8 Enviromental care																																			1|0	2|0				0|1								3|1
9 Community													1|0												1|0		1|0																0|1					3|1
10 Well-being															1|0						1|0						1|0	1|0		1|0	1|0																	6|0
11 Future													1|0				1|0	1|0	2|0	1|0	2|0					1|0			1|0							4|0		0|1			0|1							14|2
12 Knowledge transfer																2|0									1|0			1|0				1|0			1|0								0|1				0|1	6|2
13 Impact														1|0	1|0										1|0																0|1							3|1
14 Choices																2|0			2|0	1|0	2|0	1|0	1|0		3|0		1|0		1|0							1|0	0|1	0|1	0|1		0|1	0|2			0|1		0|1	15|8
15 Business strategic choices																																									1|0							1|0
16 Knowledge learning																																						1|0							1|0		1|0	3|0
17Alternatively fuel																																																0|0
18 Sustainable product																																									1|0							1|0
19 Biodiversity																																																0|0
20 Self sufficiency																																					2|0											2|0
21 Good farmer																																							1|0		2|0							3|0
22 Sustainable transition																																						1|0										1|0
23 Work																																																0|0
24 Food																																																0|0
25 Profitability																																					1|0		1|0									2|0
26 Responsibility																																												1|0				1|0
27 Well-being																																						1|0				1|0	2|0					4|0
28 Society																																																0|0
29 Care for the planet																																																0|0
30 Impact																																																0|0
31 Living countryside																																																0|0
32 Self-insight																																															1|0	1|0
33 Future																																						1|0										1|0
34 Community																																								1|0								1|0
35 Information distribution																																											1|0					1|0
36 Generations																																						1|0		1|0	2|0	1|0						5|0
37 Security																																																0|0
38 Self-achievement																																																0|0
39 Confirmation																																																0|0
40 Care																																																0|0
41 Responsibility																																																0|0
42 Legacy																																																0|0
43 Satisfaction																																																0|0
44 Well-being																																																0|0
45 Egoism																																																0|0
46 Pride																																																0|0
47 Freedom																																																0|0
sum	0|0	0|0	0|0	0|0	0|0	0|0	0|0	0|0	0|0	0|0	0|0	3|0	1|0	6|0	7|0	1|0	4|0	7|0	4|0	9|0	2|0	1|0	1|0	7|0	2|0	6|0	2|0	3|0	1|0	1|0	1|0	2|0	1|0	4|0	11|0	3|3	5|5	2|2	2|2	6|6	2|2	3|3	1|1	1|1	0|0	2|2		

Appendix 2 Master Codes

Attributes

Economic prerequisites
Afford to use HVO
Profitability
Money enables the opportunity to use HVO
A good position on the market
Environmental care
Care for the environment
Preserve the climate
Care for the environment and our planet
Care for the planet, plants and human
Preserve the planet
Take care of the earth
My concern for the planet and overall
Think about our earth
Future
I do what I can for a (sustainable) future
I want someone to take over the farming business
I want to hand over a sustainable agriculture to the future
I want to protect the future
I have decided that I want to act to care for the future
The opportunity to live on earth
Management of the land and planet

Impact
Influence others via my choices
Many are affected by the climate
Demonstrate to others that it is possible to be sustainable

Increased self-sufficiency
Because we can and increase self-sufficiency
Preparedness within the country
Restricting transport over sea
Good profitability
Knowledge transfer
Knowledge learning
Knowledge about a climate-smart production
Teach the next generation

Environmental awareness
Locally vs Globally
Important from a global perspective
Local impact also has impact globally
Nature from different perspectives
Urge to create a small universe with my family
Don’t want to be part of the global impact
Make a small difference world-wide
Caring for the local community
Making the right choice
Make the right choice by using HVO
Right and conscious choice
Right decision
Making the right choice
I can make a difference by choosing HVO
I made a decision to use HVO
Good and sustainable alternative
Dare to lead the way in the matter of sustainability

Sustainable product
Deliver a fossil-free product
Want to deliver a responsible product
Wants to deliver a” clean” product
Increased self-sufficiency

Consequences

Biodiversity
Beneficial for circularity
Benefit biodiversity
Increased opportunities and conditions for soil health
Increased biodiversity
Return to nature
Maintaining a healthy planet
Protecting the planet
Business strategic choices
Strategic choice
Use in marketing
Invest in sustainability
Credibility and trustworthiness towards customer
Commercialisation
Achieve short-term goals
Generations
Equal prerequisites for future generations
Same opportunities for future generations
Future generations
For future generations to take over
Me and my children will have a place to live

I hope my son will take over the farming business
Mankind lives on
Future generations enjoy what I enjoy today
Kindness towards future generations
Possibility to live in the future
Future generations will be in a good place
A fair start for future generations to take over
Don’t want to “steal” the soil from future generations

Good farmer

Lower climate impact with fewer inputs
Improved soil quality
Manage what I have
Avoid soil compaction
Reduce resource usage
Reduce time spent in the tractor and combine
Good for animal production
Good for crop production
Resource efficiency
Use resources and assets wisely
Efficient production
Work and time spent pays off
Create good prerequisites for the land
Use resources in a sustainable way
Aha-experience

Information distribution

Knowledge is spread
The need and aim to educate people about agriculture and food production
Inform the public about sustainable agriculture
Teach about improved agriculture
Disseminate information
Influence other through my stories

Knowledge learning

Gather my own knowledge about agriculture
Make well-informed decision
Understand correlations
Be one step ahead and constantly learn
Discuss what is most important in life, consumption, or other things?
It is of importance for my survival to make the right decisions

Profitability

Profitability enables for the decision to use HVO
Make profit
Good profitability as a farmer
Economic calculations
Good profitability enables me to afford HVO
Additional profit

Make money from my business
Good profitability and a sustainable business
Well measured business and profitability
Run a profitable business
Optimization of resources and inputs

Self sufficiency

storage for future crises and wars
Increased self-sufficiency
Provides labour opportunities in Sweden and counties nearby
preserve what is nearby
self-sufficiency
a safe foundation where I can provide for my family
Create a good place to live

Sustainable product

label my products as fossil-free
Deliver a fair product
A product I can support
Consumers will choose Swedish products
Fossil-free alternatives to the product range of today
Deliver a sustainable product
Produce fair products
Innovation-creation

Well being

Sleep well at night
Choosing HVO make me sleep well at night
Freedom and pride
I feel good
Love and affection from my surroundings
Do the best I can
Mental achievement
Caring about others make me feel good
Happiness and pride

Values

Legacy

I need to take care of my legacy as a farmer
Manage my inheritance
Legacy as a farmer

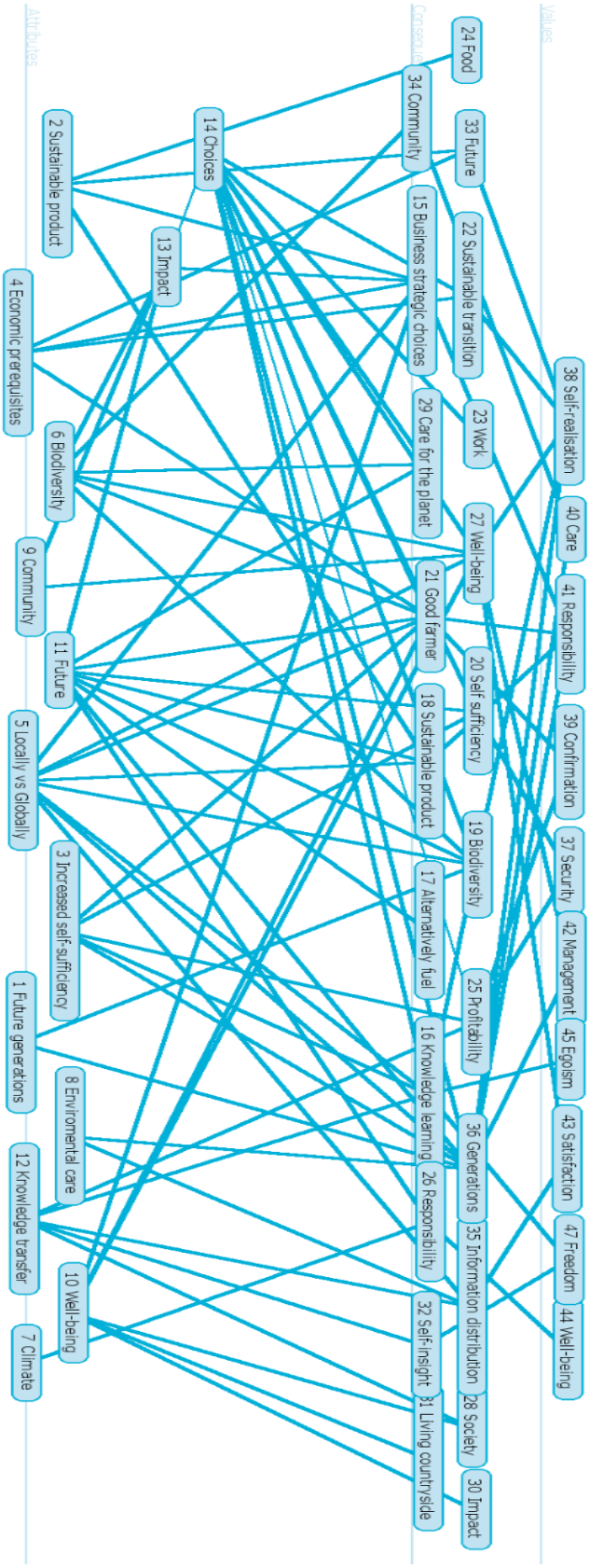
Responsibility

Because it is my responsibility
I want to do what is right
My responsibility as a farmer
Moral view
Liability and moral

Security

A safe society
Security
Self-sufficiency is important
Self-achievement
I feel self-achievement by being an inspiration
Personal development
I have a role to play
Because of personal growth
Satisfaction
I want to feel satisfied over my work
Satisfaction over my choice
Satisfaction that I can manage and use HVO

Appendix 3 Hierarchical Value Map cut-off value 0



Appendix 4 Explanations of pictures

Picture 1	The EU-flag
Picture 2	"The Scream" by Edvard Munch
Picture 3	A boy sitting on a man's shoulders with a wheat field in the background
Picture 4	Illustration of the earth with three arrows surrounding the earth
Picture 5	A combine emptying its cereals in a flake
Picture 6	Four piles of coins with small plants on top of each pile
Picture 7	Emissions from a factory
Picture 8	Empty food shelves in a store
Picture 9	A drone flying over a field
Picture 10	A flowering field and a blue sky
Picture 11	Aerial photo of a farm with surrounding fields
Picture 12	Illustration of a person raising the left fist
Picture 13	Two hands holding a plant
Picture 14	Two piglets sleeping close to each other
Picture 15	A field of oat with a big oak in the background
Picture 16	Four hands holding each other
Picture 17	A cargo vessel in the ocean
Picture 18	Military on guard duty
Picture 19	An old photograph of two people who rake grass
Picture 20	An alley with surrounding trees
Picture 21	Illustration of a utopian society
Picture 22	Three generations of people
Picture 23	Map of the planet
Picture 24	Illustration of a destroyed and dystopian society
Picture 25	Stocks market
Picture 26	Children playing with tires
Picture 27	Illustration of a stick figure standing at a crossroad
Picture 28	A big yellow fish swimming upstreams against blue fishes
Picture 29	A network of blue and purple nodes
Picture 30	A woman sleeping in a bed

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