Reduction of Meat Consumption - The case of Norway

A Master's thesis in Industrial Ecology, Psychology specialization

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Preface

This masters' thesis is a part of my Masters' program in the Industrial Ecology department with a Psychology specialization at NTNU.

My initial interest in the topic of meat consumption has been the main motivation for choosing it as the focus of my thesis. Two main aspects initiate this interest. The first relates to the ethical and moral aspects that rise in the context of meat consumption, in particular issues of animal and environmental exploitations. The second relates to the opportunities it holds for individuals to take a stand and make a valuable difference just upon a personal decision to act. Many other global-scale problems are (or seem) difficult to influence as individuals, or even to determine what is the individual's role in them; however, reducing meat consumption provides a clear, accessible opportunity for each person to affect a multi-scale problem through a basic everyday practice of food choices. Such opportunities, in my opinion, should be appreciated and adopted.

Therefore, this work allowed me to deepen my understanding of a topic I care about, and approach it with the tools of the disciplines of industrial ecology and psychology.

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Abstract

This paper integrates aspects of the disciplines of Industrial Ecology and Psychology regarding the behaviour of meat consumption, with a particular focus on the substantial contribution of the meat industry to severe environmental impacts. Based on the theory of planned behaviour, norm activation theory and protection motivation theory, a model was formed to find the barriers and facilitators for a reduction of meat consumption in Norway. A questionnaire study to test this model included 209 participants in Trondheim, Norway. The results showed that the predictors for such reduction are intention, health beliefs, attitude, and the general approach towards environmental issues, while meat eating habits form a barrier. The paper discusses several reasons for a reduction of meat consumption, including moral aspects, health aspects and environmental impacts, as well as several intervention tools and strategies for enhancing such reduction on individual and institutional scales.

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1. INTRODUCTION

Human activities have a substantial impact on the environment. Such impacts include global warming, biodiversity loss, water depletion and water pollution, air pollution, land degradation, deforestation, ozone layer depletion, and many more. Some of these are results of activities that individuals have only an indirect or limited control over, for example political decisions or technology choices of industrial operations. However, other activities are deliberatedand direct actions of individuals, including daily-life choices for household consumption.Meat consumption is such activity.

Hertwich (2005) argues that household consumption is the most important category in most developed countries for both expenditure and total energy use or CO_2 emissions.In a review of 11 studies that analyze life-cycle impacts of products, Tukker and Janses (2006) examined products' contribution to several environmental impact categories. They found that three product categories: food, housing and transport, are the most significant contributors to environmental impacts, accounted responsibility for more than 70% of the total lifecycle impacts of all products and services used for household and government consumption. Within the category of food, the most dominant contributors were meat and dairy.Hence, not only individual behavior has an impact on the environment, but it is a significant one.

Jungbluth, Tietje and Scholz (2000) argue that individuals have the possibility to reduce environmental impacts by changing their behaviour patterns, in particular by revising their food choices. The topic of this thesis- the reduction of meat consumption in Norway, represents such possibility.

An interdisciplinary thesis

This masters' thesis is an interdisciplinary thesis that combines Industrial Ecology (IE) with the field of Psychology. The industrial ecology perspective determined the focus on environmental impacts of a human action and the view of this action in the context of a whole system of influential actors. The psychology specialization of the thesis added dimensions to these aspects in the shape of both a deeper examination of the behaviour itself and the focus on the individual's role in the system. In that respect, these disciplines might be considered as complementary. Oskamp (2000) relates to the role of psychology in environmental problems. He argues that while environmental scientists

focus on the threats to the planet, psychologists can reveal the required changes in human behavior in order to avoid or minimize these threats. Kok, Benders and Moll (2006) argue that while past environmental policy was mainly focused on the supply side, current policies give much attention to the demand-side, i.e. the consumers. They argue that this change of focus is a result of acknowledging the important role of households as actors for sustainable development. Bell et al. (2001) argue that in order to improve human impact on the environment, significant changes must occur of both behaviour and technology levels, separately and integrate. This is because some environmental problems are affiliated with the use of a specific technology (for example, packaging). Moreover, many technologies account for side effects that might be eliminated through a behavior change. Second, behavior change may provide a solution to problems where technological ideas failed to do so. Finally, sometimes particular behaviours are necessary to encourage the use of a technology.

Focus and Motivation

The behavior of meat consumption is the focus of this paper. In particular, the reduction of this behavior is the main topic of this Masters' thesis. Several qualities of this behavior lead to a special interest in it:

• Meat consumption has a major impact on the environment (FAO, 2006). Moreover, the reduction of meat consumption holds a potential for a significant reduction of these impacts. Hence, this behavior well expresses the potential of individuals' action to enhance a significant impact on either increase or decrease an environmental burden. Moreover, the extent of the behavior and its consequences make it an urgent environmental problem.

• Examining this behavior includes the use of tools from both disciplines of industrial ecology and psychology. While IE provides the scientific background of the environmental impacts related to the behavior and quantitative measures of its effects, the psychological perspective analyzes the behavior in a social and personal context and emphasizes the possibilities of its management.Moreover, this behavior illustrates the complex relations of a system that includes both personal and industrial aspects and accounts for implementation and interventions on various scales.

• The components influencing this behavior, such as situational variables, social aspects and moral values, as well as their relationships are of much interest. This is both for their specific role in determining meat consumption and their qualities as determinate of behavior in general.

• Meat eating is a voluntary behavior. Not only it is unnecessary for a healthy diet, it is a leading contributor to many health problems (Gossard& York, 2003). This is of interest for two reasons: first, such behavior might hold much room for flexibility and a high potential for a change; second, it might represent a much wider group of behaviours where individuals' preferences result in environmental consequences. Such behaviours favor the satisfaction of self- interests in spite of their affect on shared values and resources, or 'commons'. This term relates to Hardin's (1968) publication, ' the tragedy of the commons', which emphasized the weighting process of one's needs against those of the community, or the choice of satisfying immediate personal interests with its prospect negative future consequences to society (Bell, Greene, Fisher, & Baum, 2001). Hardin's work initially addressed the problem of overpopulation: the choice of self serving motives for reproduction even though it could lead to long- term negative consequences for the total population who shares the same resources. However, it applies to a variety of problems, including environmental problems. For example, one's choice of a car as a main travel mode affects air quality, building a house in nature greatly affects land use and biodiversity; and meat consumption greatly affect land use, water sources, air quality and biodiversity. Moreover, while individuals might consider the impacts of their behaviours as unimportant on a global scale, as these behaviours occur on a wide scale (i.e. by many people), their consequences are magnified and they might cause severe environmental and global consequences.

Considering environmental impacts and Environmental significant behavior (ESB), the weighting process of Hardin's paper refers to the choice between personal interests and biosphere consequences, and the ESB can be related to limiting self –consumption for the future good of others.

1.1 The system of meat consumption

The main actor for meat consumption in this thesis is the individual consumer. However, the individual consumer represents only the final demand of a product within its use phase. Figure 1 shows the supply chain for meat consumption and emphasizes the location of the individual consumer within this system.
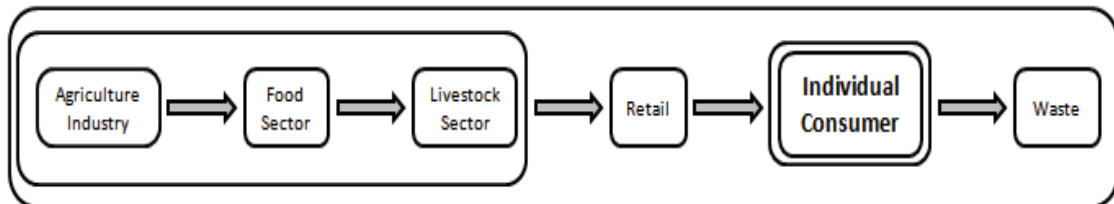
Figure 1: The supply chain of meat consumption

Hence, individual's food consumption is affected by various factors, and one's personal preferences are just a part of a system that determines the decision of food choices. Figure 2 illustrates the extended system of actors that influence this choice and includes influences on personal, social, political, industrial and environmental scales.
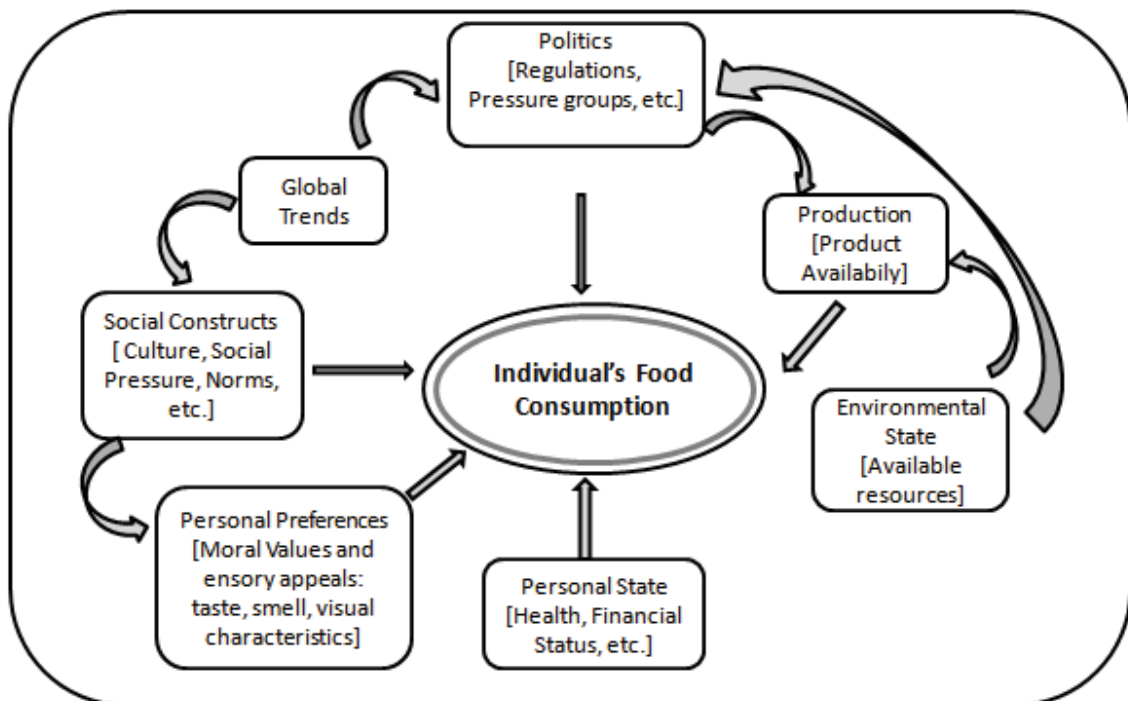
Figure 2: The main influences on individual's food consumption

1.2 Meat consumption: the extent of the problem

Global acknowledgement of the environmental impacts of the meat industry

In 2006, the Food & Agriculture Organization of the United Nations (FAO) published a report that emphasized the vast impact of the livestock industry, including the meat industry, on degrading environmental aspects. The report states that the livestock sector is one of the top contributors to the most serious environmental problems at all scales from local to global. It suggests a focus on this sector in policies dealing with environmental problems and emphasizes the urgency of addressing this sector due to its high-scale impact on the environmental problems. Furthermore, an important argument of the report is that the massive scale of influence of the livestock sector on environmental problems involves also an opportunity to mitigate these problems. This report reached much scientific attention and lead to a greater focus on the potential change in food consumption behaviour as a way to address environmental problems. Proceeding statements are found in a later report initiated by the United Nations Environmental Program (UNEP) (2010) which states that in general, animal products, especially meat and dairy products require more resources and generate higher emissions than plant-based foods. Furthermore, it argues that a "substantial reduction of impacts would only be possible with a substantial worldwide diet change, away from animal products" (p.82). Carlsson-Kanyama and González (2009) argue that while current trends in food choices suggest an increase of the environmental effects, a diet change towards plant-based foods offers an interesting option for mitigating climate change. Furthermore, Gossard and York (2003) argue that individuals' dietary habits have a significant impact on the environment. In particular, a substantial reduction of meat production and consumption can reduce the human impact on the natural environment and may increase global food security.

The size

More than 292.8 million tons of meat was produces globally in 2010, generated from the slaughtering of more than 63.3 billion animals (Faostat, 2012). FAO (2012a) estimates that 297.2 million tons of meat was globally produced in 2011, and expects an increase towards a production of 302 million tons in 2012, about 60% of that is estimated for developing countries.

The growth in population size and incomes lead to a rapid increase in the demand for livestock products. This sector is currently growing faster than all other agriculture sectors in almost all countries, and estimates that by 2050 global meat production will more than double compared to the production in the beginning of the 1990's, from 229 to 465 million tons (FAO, 2006).

Financially wise, the livestock sector accounts for a substantial portion of agricultural GDP, estimated at 40% (FAO, 2006). However, as this sector is often associated with policy distortions and market failures, its environmental burden is often found as out of proportion to its economic importance (FAO, 2009).It is an industry that generates much impact on social and natural systems. Globally, livestock production is the largest user of agricultural land and is associated with various environmental problems and implications, for example its leading role in deforestation in Latin America and the Caribbean (FAO, 2012b). The extent of social, health and environmental consequences of meat consumption are approached in details in chapter 3.

The case of Norway

Meat production in Norway in 2010is estimated at more than 328thousand tons (Faostat, 2012). Since 1989, Norwegian meat consumption increased significantly by more than 20 kg/person/year, with the highest record of consumption at about 77 kg/person/year in 2008. The current estimation is based on that of 2010, at 74 kg/person/year. The content of Norwegian meat consumption includes mainly the meat of pigs, cattle and poultry (Helsedirektoratet, 2011). In the past ten years, chicken consumption increased by 100 %, pig meat consumption increased by 20% and beef consumption increased by 10% (Noah, 2010).

Within household consumption in Norway, shelter, mobility, and food are the most important consumption categories for environmental impacts (Hertwich, 2005).

1.3 Research question and the design of this paper

Accounting for the specific characters of the behavior in question and its performance in the specific context of Norway, the research question of this thesis is: What are the facilitators and barriers for the reduction of meat consumption by individuals in Norway?

In order to address this question, a questionnaire study was conducted to identify individuals' drivers for meat consumption and its reduction.

The influence of both disciplines of industrial ecology and psychology is reflected through the paper. Specifically, it is expressed by both a detailed chapter of psychological theories that lay the grounds for the study included in the thesis, and an extended background chapter that describes additional elements of the extended system of the behavior, with a special emphasizes the environmental aspects that are accounted for the topic of meat consumption. Moreover, the emphasis on implementation options through the system that are included in the discussion chapter are much inspired by both psychological interventions and IE frameworks.

The next chapter describes the psychological theories that are accounted for in this thesis and led the basis for the thesis study. This is followed by a background chapter that reviews the main reasons for reducing meat consumption. Next, the empirical study included in this thesis is described through its method and results. A discussion chapter integrates the above and puts an emphasis on implementation options through a holistic system approach. Finally, a conclusion chapter summarizes the paper.

2. THEORIES

Bamberg and Schmidt (2003) argue that the development of models for studying environmental behavior has become a main interest in the field of social science research. They argue that past studies were mainly exploratory in nature and examined the variables without applying a strong theoretical basis or providing a clear relation between the factors; however, the 1990's brought a shift towards the use of well-established social-psychological theories for explaining and predicting environmental behavior became more apparent. These theories include the Norm Activation Model (Schwartz, 1977), Protection Motivation Theory (Rogers, 1983), the Health Belief Model (Rosenstock, 1974), the Theory of Reasoned Action (Ajzen & Fishbein, 1980) and the Theory of Planned Behavior (Ajzen, 1991). As these models are theory-driven, they provide the advantage of containing detailed operationalizations of the theoretical constructs as well as specifying the causal processes through which they influence behavior.

Three theories were chosen as most relevant for this thesis: the Theory of Planned Behavior, the Norm Activation Model and the Protection-Motivation theory. The main parameters for choosing these theories were both the variables accounted for in their constructs, which are assumed to be of much relevance for the current topic of reduction of meat consumption, and their areas of application, which include behaviour change in relation to environmental concerns, consumption habits and food choices.

This chapter presents the main characteristics of these theories. Each theory is described by its main argument and formation, a detailed description of the model's variables and construct, and an overview of the model's application. A summary follows and discusses the models and their specific relevance to the current topic of reduction of meat consumption in Norway. Finally, the chapter provides the hypothesis of the study.

2.1 Theory of Planned Behavior

The Theory of planned behavior was developed by Icek Ajzen in the early 1990's as a major framework for understanding, predicting and changing human social behavior. This theory finds intention an immediate antecedent towards a behavior, and in itself, an integration of attitudes, subjective norms and perceived behavior control- variables that are based on beliefs about the behavior's likely consequences, the normative expectations

of important others, and the presence of factors that control behavior performance, relatively (Ajzen, 2012).

The theory of planned behavior is based on a ***reasoned action approach***, and in fact it is an extension of Ajzen and Fishbein's ***Theory of Reasoned Action (TRA)*** (Ajzen, 1991). The main argument of this approach is that behavior is not performed automatically or regardless of thoughts, but it follows reasonably and consistently from available relevant information. The Theory of Reasoned Action includes two main attributes: the use of attitudes to predict and explain individual behaviors, and the acknowledgement that it is not only personal attitudes, but also perceived subjective norms[1], that play a major part in one's considerations towards a performance of a given behavior (Ajzen, 2012). This theory was confined explicitly to behaviors of which people have complete volitional control over (Ajzen, 2012). Though the Theory of Reasoned Action was widely applied and was established as a comprehensive model of behavior (Albarracín, Johnson, Fishbein, & Muellerleile, 2001), the accommodation of behaviors which people have complete volitional control over put a strong limitation on its application. The Theory of Planned Behavior was designed to accomplish the goal of incorporating a wider variety of behaviors into the model (Ajzen, 2012). This extended theory includes an additional variable of 'perceived behavioral control' to predict intentions and behaviors that are not under complete volitional control (Albarracin et al., 2001).

Though rooted in the reasoned action approach, TPB does not assume people to act in a rational, impassionate, unbiased way. Instead, it acknowledges that beliefs often fail to reflect reality, as they might be inaccurate, incomplete, biased, serve self-serving motives, etc. While in-depth processing is reserved for important decisions and behaviors in new situations, the theory acknowledges that most of the everyday-life and routine behaviours are performed without much cognitive effort, often even bellow concious awareness (Ajzen, 2012).

Variables

The Theory of Planned Behavior assigns ***intention*** as the immediate determinant of volitional behavior. The intention in itself is generated by three variables: attitude toward

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[1] Both the terms 'subjective norms' and 'social norms' are commonly used for this variable.

the behavior, subjective norm, and perceived behavioral control (which may also exert a direct influence on behavior). Each of these three variables is determined by behavioral beliefs, normative beliefs, and control beliefs, relatively (Gangé & Godin, 2000).

Attitudes: Gangé and Godin (2000) define the attitude component in the theory as the personal evaluation of the behavior in question. Aligned with the TRA, an attitude is a result of both behavioral beliefs that people hold in relation to a behavior, and the values attached to the outcomes of the behaviour. Hence, it is assumed that beliefs are held regarding all alternative behaviours, and these are attributed as favorable or unfavorable through a weighting process of the potential outcomes of the behaviour. Furthermore, it is not all beliefs and their consecutive potential outcomes that are to be considered, but only those that are readily accessible in one's memory. These beliefs are the considerations that guide the attitude, social norms and perceived control that would influence the intention and behavior in a given point in time (Ajzen, 2012).

Subjective norms: Subjective norms refer to the perceived expectations of other people: The way one thinks other people expect one to behave and their level and nature of support of the behavior (Klöckner, 2011). The theory assumes that the perceived subjective norm is a result of combining normative beliefs regarding the extent to which specific other/s want/s one to perform a given behavior (Ajzen, 2012). Thøgersen (2006) further divided subjective norms into injunctive and descriptive norms. Injunctive norms represent other's expectations of one's behavior, determining what is right and appropriate, while descriptive norms are simple representation of what others do (Klöckner, 2011). Ajzen (2012) argues that there is a difference between the conceptualized and practical relationships between attitudes and subjective norm. While these are conceptually independent (for example to the extent that one holds a positive attitude towards a behavior, yet perceive social pressure not to perform it), in practice they are rarely completely opposite of each other.

Several studies found subjective norm to be a poor predictor for intentions (for example Povey, Wellens and Conner, 2001; Godin & Kok, 1996). Povey et al. (2001) argue that while the reason for that might be that the variable was not of much importance for the question in matter, it is also possible that it is a consequence of a poor predictive power of the construct.

Perceived behavioral control (PBC) is the extent to which one believes s/he can perform a behavior if s/he decides to. Its conceptualization for the model by Ajzen was based on Bandura's work on self efficacy, in particularly his emphasis on self efficacy being a context-related variable rather than a general trait, referring to one's ability to handle specific actions required for a particular goal. This variable is derived from control beliefs- readily accessible beliefs about the presence of factors that may fascilitate or inhibit the behavior and the perceived power of these factors (Ajzen, 2012). This variable is comprised of two components: self-efficacy, referring mainly to the ease or difficulty of performing a behavior, and controllability, which refers to the degree to which the execution of a behavior is up to the person. These components reflect beliefs regarding both internal and external factors that contribute to PBC (Ajzen, 2002). Availability, accessibility and price are examples of external components attributed to PBC and that are of relevance for the current paper. These are situational conditions that were found influential in the domain of food consumption (Klöckner, 2011). For example, a lack of availability, poor accessibility and high price relate to purchase inconvenience and were found as barriers to organic food purchase (Zanoli & Naspetti, 2002; Hughner, McDonagh, Prothero, Shultz, &Stanton, 2007).

Ajzen (2012) argues that PBC plays several potential roles in the Theory of Planned Behavior. First, it can influence the behavior performance directly by effecting preservance. Hence, the more people believe that they can perform an intended behavior, the more likely they are to preserve and succeed in it. Moreover, Ajzen (1991) argues that while both intentions and PBC might make significant contributions to the prediction of behavior, the relative importance of these variables for predicting behavior is expected to vary across situations and behaviors, even to the extent where only one of them is in fact needed. For example, for behaviors of which people have lower volitional control over, PBC should become a stronger predictor. However, Wallston (2001) emphasizes that though in general one's greater sense of control would lead to a higher likelihood of engaging in an appropriate behavior and producing a better outcome, yet the relationship between control beliefs, behavior, and outcomes is not always straightforward. He argues that control beliefs include several different aspects. One of them is *locus of control,* which refers to the 'location' of the belief, i.e. whether it is an internal (for example

based on self-behavior) or external (based on luck, a given condition etc.) to the individual. Furthermore, these beliefs are independent, therefore internal and external beliefs regarding the locus of control might be held simultaneously for a single phenomenon (for example, assigning the internal beliefs of drinking habits and external beliefs of bad gens- external beliefs to a poor health state). Another control belief is *Self-efficacy*, which refers to the belief that one can perform a specific behavior in a specific situation, and Wallston argues that self-efficacy is a much stronger predictor for an actual engagement in a specific behavior than internal locus of control. Though both self-efficacy and PBC refers to one's belief that the behavior in question is under her/his control, these two components differ from one another, and self efficacy is only one of PBC's components. While self-efficacy is operationalized by the individual's confidence in her/his ability to perform the behavior, PBC is often assessed by the extent of the difficulty (or ease) to execute the behavior (Wallston, 2001). Cheung, Chan and Wong (1999) question the construct of PBC. They argue that Ajzen's original formulation of PBC included both perceived difficulty to perform the behavior and perceived controllability over its performance; measuring these two components separately might lead to a more accurate analysis than measuring PBC as a unidimensional component. A support for this argument can be seen at Chan and Fishbein (1993) who argue that it is possible that one views a behaviour as difficult yet believes that she/ he can successfully perform it, and vice versa. Hence, despite an existing strong intention, some behaviors might imply difficulties that would dismiss their execution. Therefore, PBC can be used as a tool to achieve better realistic prediction on behavior, in addition to intention. (Ajzen, 2012).

The second influence PBC might have is an indirect effect on the behavior performance, as a third determinant (in addition to attitude and social norm) for intention. Hence, a greater blief in the ability to execute a behavior would contribute to a stronger intention to perform it; consequently, without a belief in the ability to perform a behaviour, it is unlikely one would form an intention towards the behaviour. Third, perceived behavior control might serve a proxy for actual control. While actual control might be a strong determenant for the formation of intention towards a behaviour, it is often very difficult

to identify and measure the factors that may facilitate or inhibit behavioral performances. Figure 3 summarizes the construct of the Theory of Planned Behavior.
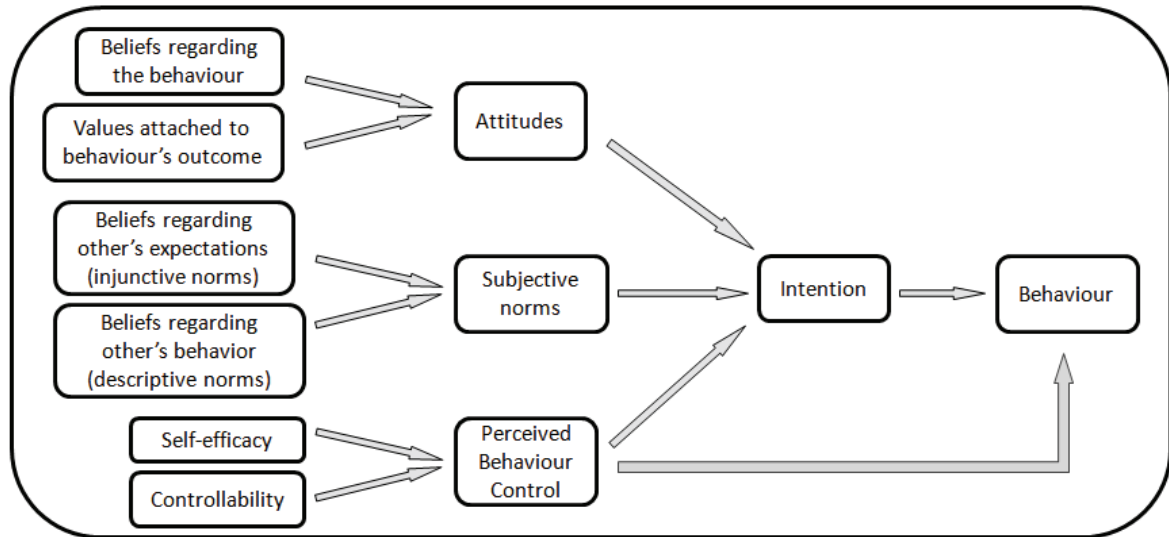
Figure 3: *The Theory of Planned Behavior*

According to this model, intentions and PBC have a direct influence on behavior. Ajzen (1991) emphasizes that there is not a fixed hierarchy regarding the relative importance of these in the prediction of behavior. Instead, this importance varies between situations and behaviors. Ajzen (2012) argues that intention alone can produce an accurate prediction in cases where control is systematically high so that virtually everyone can perform the behavior if desired. However, when the degree of control varies among individuals, it is both intentions and control that affect the behavioral performance. Furthermore, Ajzen (1991) argues that several conditions have to be met for the theory to produce an accurate prediction of a behavior: intentions and PBC must be specific to a particular behavior and rely to a particular context in which the behavior is to occur; intentions and PBC must remain steady through the interval between their time of assessment and the occurrence of the behavior; PBC should be as close as possible to reality for an accurate reflection of an actual control.

A meta-analysis review of TPB was conducted by Armitage and Conner (2001) and included 185 studies that were published until 1997. They found TPB to account for 27% of the variance in behavior and 39% of the variance in intention; PBC accounted for substantial amounts of variance in intention and behaviour. The authors argue that their

findings support the efficacy of TPB over TRA. These findings include direct and indirect effects of the additional TPB variable of PBC on behavior and intention. Another meta-analysis, by Notani (1998) found PBC to be an antecedent to both the intention to perform a behavior and behavior itself. Furthermore, the author argues that PBC is a stronger predictor of behavior when it is operationalized as a global measure (in comparison to a belief-based measure), conceptualized to reflect control over factors primarily internal to an individual (in comparison to external factors), relating to a sample of non-student individuals, and when applied to familiar behaviors.

Verplanken and Aarts (1999) argue that *habits* are important to consider for predicting repeated behaviours, and should be accounted for in the model. Verplanken, Aarts, Knippenberg and Moonen (1998) relate to habits as "learned acts that become automatic responses to situations, which can be functional in obtaining certain goals or end-states" (p. 112). Often, habits are situation specific, yet the authors argue that habitual behaviour patterns can be identified on a more general level. They argue that in some cases, one might be motivated to engage in more deliberate decision making in spite of a strong habit, due to situational determined reasons. In a study examining travel mode choices, they found a significant relation between habits and intention. Moreover, habit strength was found as a moderator of the intention-behaviour relation. The authors argue that while TPB has been quite successful in modelling antecedents of behaviour only when habits were weak; however, when the behaviour is habitual, other processes than those suggested by TPB should be considered. These processes are habitual choice processes, and they usually involve routine-shaped automatic associations between settings and habitually chosen options. Verplanken and Aarts (1999) emphasize that habits as behaviours include automaticity characteristics and therefore can be performed unintentionally, uncontrollably, efficiently and without awareness. They argue that while habits seem hard to break, they are often controllable to some extent.

Criticism on TPB includes the following arguments: Arvola et al. (2008) argue that the theory lacks a sufficient consideration of affective and moral influences on behavior. For example, they argue that TPB assumes attitudes to be based on cognitive beliefs, while this component has been empirically confirmed to be a complex construct that includes both cognitive and affective components. While the cognitive component

refers to thoughts that people have about the behavior, the affective component refers to feelings and emotions that people attach to the behavior. The authors argue that simultaneous consideration of these two components will provide a better prediction of behavior than considering one dimension of attitudes only. Furthermore, they argue that the influence of normative or moral aspects on behavior are insufficiently expressed in TPB, as the theory assumes these influences as mediated through subjective norms and attitudes. They emphasize that subjective norms relate to a perceived social pressure or shared rules of right and wrong shared by a group, hence, they do not necessarily reflect the individual's own point of view. This criticism is shared by Jackson (2005) who argues that the model accounts for several problems that are common to rational choice models in general. Hence, he emphasizes the importance of affective responses that confound cognitive deliberation and argues that while people's behaviors are based more on emotional response than on conscious deliberation, they are not included in the model. Moreover, he questions the cognitive ability of people to take deliberative action, as he argues that the cognitive processes are often reduced by a variety of mental 'short-cuts'. These include habits, routines, cues, heuristics, and some level of automaticity in the behavior, which contributes to the difficulty to make a change. Lastly, he questions some of the assumptions held by these theories: he argues that while they assume self-interest and individuality to be determinates for behavior, human behaviour consists of social, moral and altruistic behaviours as well; not only behavior usually occur in a social context, but it is also the social and interpersonal factors that continually shape individual preference.

Application

The Theory of Planned Behavior has been widely applied. Ajzen (2012) argues that it is the most popular of the reasoned action models, and knowledge gathered using this theory provides a basis for effective interventions, aimed on modifying behavior in a desirable way.

Its application includes a variety of domains such as environmental behavior, social and sexual behavior and health, and studies regarding behaviours such as exercising, eating, healthy diet, blood donating, safe sex practice, drug use, energy conservation, public

transport use and many more. The following section present examples for applications of TPB.

In the environmental behaviour domain, Cheung, Chan and Wong (1999) applied the theory to examine wastepaper-recycling behavior among college students in Hong Kong. Their sample included 282 individuals and data was collected by a questionnaire. They found that TPB significantly predicted both behavioral intention and actual behavior. The authors differentiated between perceived difficulty and perceived control. While perceived difficulty predicted behavioral intention and moderated the correlation between intention and behavior link, perceived control had no significant effect; Bamberg, Rölle and Weber (2003) examined the effects of an intervention in a changed decision context on travel mode choice by car users. The sample included 161 participants who had moved to Stuttgart, Germany. Data was collected by questionnaires using the constructs of TPB before and after the move and assessed travel mode choice. The intervention took place prior to the second questionnaire. It included an official welcome letter from the public transportation company, a short presentation of the company and its services, an invitation to test these services with a free ticket for one day, and all the information needed for using these services. They found substantial differences between travel mode choices reported in the two questionnaires: the share of public transport rose from 12.8% to 29.3%, car use declined from 55.5% to 41.8%, and the share of bikers decreased from 12.7% to 5.8%. The share of walking trips remained unchanged. These results show that the behavior was not determined by car users' habit that is automatically activated by goal-related cues. Instead, the intervention influenced attitude, subjective norm, and PBC, that were found to be the main agents for the change of travel mode, and supported TPB's constructs. Hence, even for a routine behaviour, introducing new information in a new decision context and an intervention may change the cognitive foundation of intention which changes the intention that determines the consequent behaviour.

Plotnikoff, Lippke, Courneya, Birkett, and Sigal (2010) applied TPB in the health domain, for explaining physical activity for Type 1 and Type 2 diabetes in an adult population sample. The results for both groups of diabetic type supported the constructs of the model as attitudes, subjective norm and PBC were all significantly associated with

intention and intention was found as the strongest predictor to behavior. However, when adjusted for past behaviour, the impact of PBC and intention on the behaviour was lower in both groups.

Arvola et al. (2008) applied the theory in the domains of food choices and sustainable consumption. They used the case of purchase intentions of organic foods to examine the usefulness of integrating measures of affective and moral attitudes into TPB. Their data was collected using a questionnaire in Italy, Finland and the UK with a total sample size of 672 participants. They found that attitudes, moral attitude and subjective norms explained considerable shares of variances in intentions; a study by Povey et al. (2001) examined attitudes towards meat consumption. The authors compared four dietary groups: meat eaters, meat avoiders, vegetarians, and vegans, on the basis of their beliefs, attitudes, and the extent to which attitudes influence intentions to follow each diet. Their findings complied with the construct suggested by the theory, as attitudes, subjective norm and PBC were significant predictors of the intention to follow each diet (with the exception of the vegetarian diet, where subjective norm was non- significant). The authors accounted for attitudinal ambivalence, which suggests that ambivalent people may perceive both advantages and disadvantages towards the behavior simultaneously, or have both positive and negative attitudes together. In their study, attitudinal ambivalence was found to moderate the relationship between attitude and intention. Overall, PBC was the strongest predictor of intention for vegetarian and vegan diets, attitude ambivalence interaction was the strongest predictor variable for intentions to eat meat, and social norms were the weakest predictors of intentions.

2.2 Norm Activation Model

Schwartz's 'Norm-Activation Theory' (1977) focuses explicitly on the moral and normative dimensions of human behavior, and was created with the motivation of providing a framework for understanding pro-social, altruistic behaviors. It suggests that moral behaviors emerge as a result of personal norms that arise from two components: one's awareness of the consequences of her/his actions, and one's ability and willingness to assume responsibility for those consequences. Hence, these individuals are aware of adverse consequences of an action (or non-action) and believe that particular conditions pose threats to others, and comply with ascription of responsibility to the self by

acknowledging that their actions might avert those consequences. It is this feeling of strong moral obligation that people experience and that lead to their engagement in pro-social behavior (Jackson, 2005). Harland, Staats and Wilke (2007) argue that the process of 'norm activation' refers to the construct of self-expectations regarding pro-social behavior. They argue that these behavioral self-expectations are the 'personal norms' that are experienced as feelings of moral obligation. NAM is sometimes referred to as a model of altruistic behavior (for example Hopper & Nielsen, 1991; Stern, Dietz, Abel, Guagnano, & Kalof, 1999).

Variables

NAM includes three main variables[2] to predict pro-social behavior: personal norms (PN) relates to the feeling of moral obligation to perform or inhibit a specific actions; awareness of consequences (AC), relates to whether someone is aware of the negative consequences for others when not acting pro-socially; ascription of responsibility (AR), relates to the feelings of responsibility for negative consequences of not acting pro-socially (De Groot & Steg, 2009). The following section describes these variables.

Personal norms refer to a person's own views about right and wrong, and therefore are sometimes called 'moral norms' (Arvola et al., 2008). The main difference between this variable and 'subjective norms' is that for personal norms, the consequences of either their defending or violating are tied to one's self-concept, and not to one's perceived social concept as it would for social norms (Arvola et al., 2008). Ajzen (1991) argues that in some contexts, there is indeed a need to consider not only perceived social pressures but also personal feelings of moral obligation or responsibility to perform or inhibit a given behavior.

Personal norms have two direct psychological antecedents: *Awareness of Consequences (AC)* of one's actions, and *Ascription of Responsibility (AR)* which refers to the acceptance of the personal responsibility for these consequences (Jackson, 2005). AC and

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[2] Various versions of the models rose through the research and application of NAM, which expand the model beyond these basic components. For example, Harland, Staats and Wilke (2007) include four situational factors and two personality trait as the activators for the model.

AR are sometimes referred to on the negative side, for example De Groot and Steg (2009) define AC as one's awareness towards the negative consequences when not acting on a moral behavior, and AR as feelings of responsibility for the negative consequences when one is not acting prosaically.

Figure 4 illustrates the relation between these variables. Hence, the model suggests that awareness of consequences and ascription of responsibility are the components that would activate the personal norm, and that personal norm would have a direct influence on the behavior. For example, if one is aware of the consequences of dairy consumption on water pollution and is prepared to accept responsibility for her/his own dairy consuming behavior, and then the theory assumes that one is more likely to develop a personal norm to reduce this consumption.
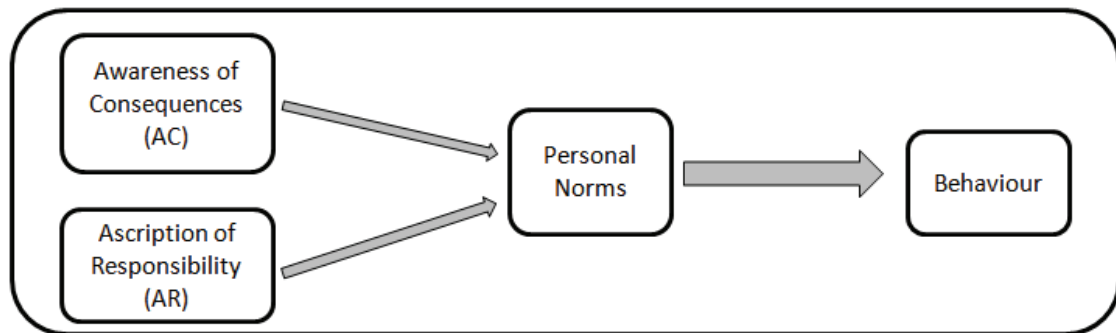
Figure 4: Norm Activation Model

Hopper and Nielsen (1991) argue that the link between personal norms and behavior is a crucial link in the model as while some individuals might internalize norms, but might still not act upon these norms; personal norms will be activated only if they are defined as relevant and applicable to a situation. Furthermore, Jackson (2005) argues that the relationship between personal norm and behavior is often moderated by the extent of external contextual or situational constraints that might facilitate or obstacle the behavior. He argues that in the domain of pro-environmental behavior, the single biggest factor interfering with personal norms and impeding pro-environmental behaviors is the existence of external social or institutional constraints.

The model has been widely applied; however it has been receiving some criticism. DeGroot and Steg (2009) argue that the relationships between the main variables of the model are not fully clear and present two common interpretations for the NAM: The first

interpret the model as a mediator model. In this approach, awareness of consequences and ascription of responsibility are assumed to have an indirect effect only on the behavior through personal norms; Personal norms are assumed to mediate the relationship between ascription of responsibility and behaviors, and ascription of responsibility is assumed to mediate the relationship between awareness of consequences and personal norms. The second interpretation refers to the model as a moderated model, where the relation between personal norms and behavior is moderated by awareness of consequences and ascription of responsibility. According to this approach, the relationship between personal norms and behavior is expected to be especially strong among people who hold high levels of awareness of the consequences of not performing the behavior and who feel highly responsible for the consequences of this behavior. And vice versa, when the perception of AC and AR is low, personal norms are less likely to influence the behavior as people may deny the problem or their responsibility over it.

Figure 5 demonstrates these two interpretations. The authors argue that knowing the nature of the relationships between the model components is important for an efficient promotion of pro-social behaviors. For example, for a mediator model, policy should focus first on raising awareness of the problem before focusing on responsibility or norms; for a moderator model, increasing responsibility may be an effective component to focus on. However, it should be noted that while the balance between components' importance might differ for each interpretation, both AC and AR are essential for both the mediator and the moderator models.
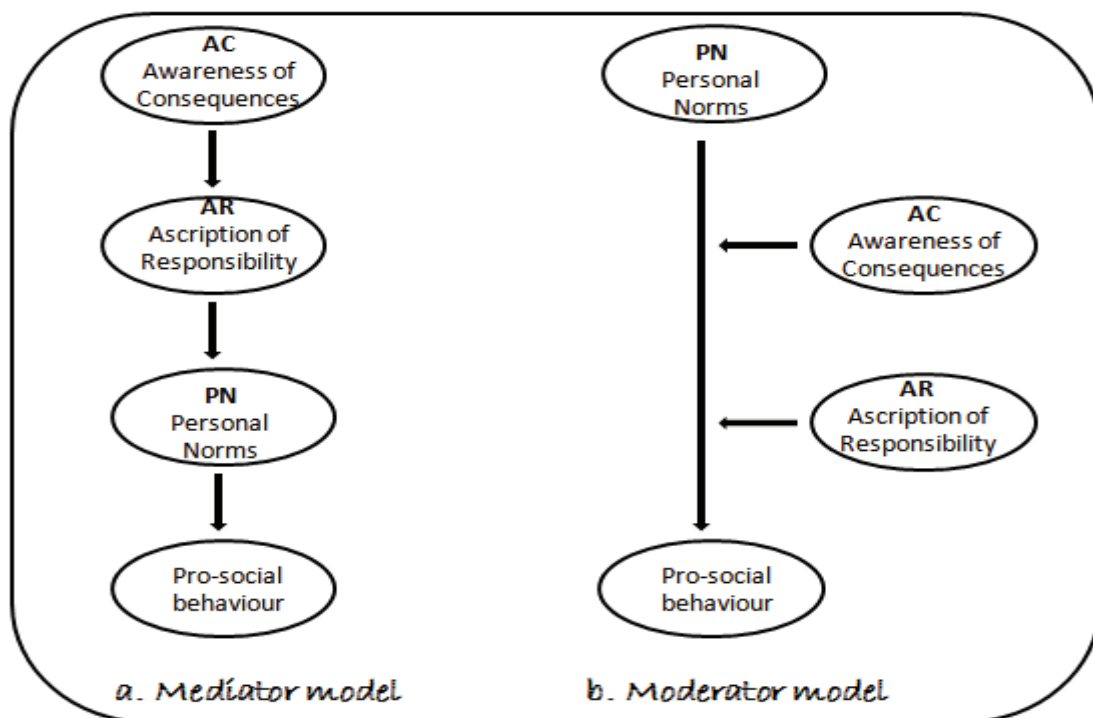
Figure 5: *Two interpertations of the Norm Activation Model. 5a: a mediator model; 5b: a moderator model (based on De Groot & Steg, 2009).*

The model has been also criticized for ignoring important contributors of pro-social behavior (De Groot, 2008; Harland et al., 2007). Furthermore, De Groot (2008) argue that empirical studies using NAM often fail to include values into the model, and that the model does not clarify the relevant values to explain pro-social behavior.

These critics lead to adjustments and extensions of the norm activation model. The **Value- Belief- Norm theory (VBN)** developed by Stern et al. (1999) is a popular extension of the norm activation model. Its main adjustment is the inclusion of richer relationship between values, beliefs, attitudes and norms (Jackson, 2005). In fact, the model explicates how values are related to the NAM (De Groot 2008). This theory was widely applied in the environmental domain and has been used to explain environmental significant behavior. The Value-Belief-Norm theory of environmentalism is an integration of Schwartz's value theory, the norm activation model and the New Environmental Paradigm by Dunlap and van Liere. These three theoretical components were linked through a causal chain leading to the activation of moral obligation towards pro-environmental behaviour (Stern et al., 1999). Hence, the model implies that different

types of environmentally significant behaviour (ESB) are predicted by different patterns of values, norms and beliefs (Honkanen, Verplanken & Olsen, 2006).

Application

Schwartz's Norm Activation theory is one of the most widely applied models of moral behavior (Jackson, 2005). The model has been applied in the domain of interpersonal pro-social behavior, for example to study behaviours such as volunteering to read to blind children (Schwartz & Howard, 1982), donating blood (Zuckerman & Reis, 1978) and helping in emergency situations (Schwartz & Clausen, 1970). Furthermore, it has been widely applied also in the environmental domain. For example, in studying behaviours such as recycling (Hopper & Nielsen, 1991; Thøgersen, 1996), transport modes (Hunecke, Blöbaum, Matthies & Höger, 2001; Bamberg & Schmidt, 2003), energy conservation (Black, Stern & Elworth, 1985), proenvironmental political behavior (Joireman, Lasane, Bennet, Richards & Solaimani, 2001) and more. When applied to pro-environmental behavior, the theory suggests that the behavior occurs in response to personal moral norms about pro-environmental actions; these are activated in individuals who express awareness of consequences by believing that environmental conditions put threats to others (whether it is other people, other species, or the biosphere) and express their ascription of responsibility believing that their actions could help in the prevention of those consequences (Stern et al. 1999). De Groot (2008) find this model to be successful in explaining a variety of environmentally significant behaviors.

De Groot and Steg (2009) argue that pro-environmental behavior is considered a special case of pro-social behavior. That is because pro-environmental behavior implies that people benefit others; moreover, in most cases no direct personal benefits are received by engaging in these behaviors.

A study by Hopper and Nilsen (1991) examined the extent to which recycling could be perceived as an altruistic behavior. The study included residents of a large urban neighborhood in a communitywide curbside recycling program and initiated two interventions: one was the introduction of block leader. This included volunteer residents who visited the households on their block, talked to their neighbours about the recycling program and encouraged them to recycle, and distributed prompts prior to the monthly

recycling pick up date. The other intervention was used for comparison and included prompting by distributing a flyer that introduced the recycling program. They found that the block leader intervention generated the most substantial impact: after a 7 months period of the study, a third of the households that were exposed to the intervention were recycling regularly, and others- occasionally. While the block leaders' intervention raised altruistic norms and increased behavior, the prompting intervention increased behavior as well but did not raise altruistic norm. The results showed that recycling may be considered an altruistic behavior as it was consistent with Schwartz's altruism model and was influenced by social norms, personal norms and awareness of consequences; social norms influenced behavior only through personal norms, and personal norms influenced behavior only when AC was substantial. The authors argue that this finding supports the argument that that pro-ecology behaviours are shaped by moral norms.

De Groot (2008) conducted two questionnaire studies to explain three types of ESB's: acceptability of a transport pricing measure, intention to reduce car use, and buying organic food. They used NAM together with egoistic, altruistic and biospheric value orientations. The first study aimed to examine whether the NAM as a mediator model is successful in explaining the acceptability of a transport pricing policy and intention to reduce car use in an optional future such a policy situation. It included 489 participants from five European countries. The second Study aimed to further examine the NAM as a mediator model by testing the contribution of value orientations, AC, AR and PN to the explanation of organic food consumption. This study included 109 Dutch participants. The results from both studies suggested that variables included in the NAM together with egoistic, altruistic and biospheric value orientations are successful in explaining variation between people in these ESBs. A VBN construct was supported as variables were significantly related by their order at the causal chain, moving from relatively stable general values to behaviour specific beliefs and ESB. Moreover, strong moral obligations were related to higher acceptability levels of a pro-environmental policy, and the authors argue that in some cases the PN was the only significant predictor to explain buying biological food. However, the authors argue that in some cases the relationship between values and ESB were more complex than suggested by Stern; for example, values related to the behavior not only indirectly through AR and AC, but also in a direct relation.

Furthermore, biospheric values, which reflect how concerned individuals are about collective interests and the biosphere, substantially contributed to the explanation of PN in both studies.

The model has been applied also for cases of food choices. Honkanen et al. (2006) applied the NAM to study the relations between ethical food choice motives, attitude towards organic food and intention to consume organic food. Their study included a sample of 1283 Norwegians and data was collected by self-reporting questionnaires. They chose three ethical value dimensions: ecological, political and religious food choice motives. Significant relation was found between all of the value dimensions and attitudes, and between attitude and intention to consume organic food.

2.3 Protection-Motivation Theory

Protection-motivation theory formulates the effects of threatening health information on attitude and behavior change (Rippetoe & Rogers, 1987). The theory was introduced by Rogers in 1975 and has since been widely adopted as a framework for the prediction and intervention planning of a protective behavior, particularly health-related behavior (Milne, Sheeran & Orbell, 2000). A later, extended, version of the theory was introduced in 1985.

A fundamental assumption of the theory is that cognitive appraisal of an event as both harmful and likely to occur, together with the belief in a suggested behavior that can prevent the harmful event effectively, can generate protection motivation. Hence, no change in behavior is expected if an event is evaluated as not severe, unlikely to occur or that there is nothing that can be done for its prevention, because in such case a protection motivation would not be aroused (Rogers, 1975).

Rogers (1975) argues that the PMT was developed based on expectancy-value theory which suggests that the tendency to act in a particular way is a function of the expectancy that the this act will be followed by some consequences and the value of these consequences. It was also developed within the field of fear-arousing communication (or 'fear appeals'), where a central question was whether fear arousal alone can directly influence cognition, attitudes, intentions and health behavior (Boer & Seydel, 1996; Conner & Sparks, 1996). This communication includes information about a threat to an individual's well-being and suggests measures that can be taken to minimize its impact

(Milne et al., 2000). In general, all research on fear appeals and persuasion has attempted to discover ways to persuade people to act in their own best interest (Rippetoe & Rogers, 1987). Therefore, establishing the way in which fear arousing communication can change attitudes and behavior is of main focus in this approach. Roger's theory addresses the need for identifying the variables involved and their cognitive meditational effects. Hence, it aims to provide conceptual clarity in the area of fear appeals and to bridge the gap between research on fear appeals and research on attitude change (Milne et al., 2000).

In 1983, Rogers revised the theory into a more general theory of cognitive change (Milne et al., 2000). While the main focus of the original version was to provide a conceptual definition for a comprehensive fear appraisal, the later version presents the theory as a general theory of persuasive communication that focuses on the cognitive processes that lead to a behavioral change (Boer & Seydel, 1996). Conner and Sparks (2005) argue that the revised version includes a larger scope of factors that initiate cognitive processes. This is supported by Milne et al. (2000) who argue that the new version accounts for more information sources that could initiate a coping process and lead to a protection motivation, in addition to fear appeals. These include observational learning, personality, and past experience. Moreover, the authors argue that the scope of coping appraisals has been extended as well to include self-efficacy and response costs in addition to response efficacy.

Several authors raised criticism of the model. For example, Pechmann, Zhao, Goldberg, and Reibling (2003) argue that while both versions of PMT account for interactions between its components, the revision of the model excluded several interactions that were found to be of importance after all. For example, two- way interactions between severity and vulnerability and between self-efficacy and response efficacy are not included in the new version. Weinstein (1988) pointed out measuring problems in the model. He argues that the measure of perceived vulnerability is biased as it takes people's awareness of the threat for granted. This argument is based on the measuring technique that includes asking participants to estimate their personal vulnerability to a threat, without giving them the option to say that they are not even aware of it. Furthermore, Weinstein notes that there is a misguidance in the

conceptualization of this variable as static in the model, whereas, he proposes, vulnerability develops in a series of three stages: the first stage includes hearing about the threat and becoming aware to its existence; the second stage involves an assessment of the danger held by the threat and its scope of affect ; the final stage includes personalizing the threat, and it is only then that the individual can estimate his/her own personal perceived vulnerability. Floyd, Prentice-Dunn and Rogers (2000) add that vulnerability might be biased because it is difficult for people to accurately estimate outcome probabilities, for example due to the availability heuristic. Moreover, they emphasize the possibility that each component of the model and the appraisal processes might be affected by cognitive and motivational biases.

Pechmann et al. (2003) argue that the model should be expanded into the area of social risks. They conducted a study to examine the effect of different informative advertisements on smokers' cognition and their intentions to engage in non-smoking behaviours. Three message themes were found to generate the most nonsmoking intentions; these themes increased participants' perception that smoking poses serious social disapproval risks. Moreover, the authors argue that it is possible to distinguish between social risk severity and vulnerability and their complementary health components, and that perceived social risk severity hold a significant influence on the predictive validity of behavioral intentions. They argue that people may be motivated to engage in a healthy behavior for the reason of avoiding social or interpersonal risks.

Milne et al. (2000) argue that an important strength of the model is its predictions being often tested in experimental studies. The advantage of this quality is its contribution for the establishment of successful experimental manipulations on changes in beliefs.

The theory has been mainly used in these two forms: as a framework to develop and evaluate persuasive communications, and as a social cognition model for the prediction of health- related behavior (Conner & Sparks, 2005). It is the second form that is of relevance for the present study.

Variables

The first version of the model included the three crucial components of a fear appeal suggested by Hovland, Janis and Kelley (1953): an event's magnitude of

noxiousness, its probability of occurrence, and the efficacy of a protective response (Rogers, 1975). A cognitive mediational process was suggested for each of these components: The magnitude of noxiousness initiates perceived severity; the probability of occurrence initiated perceived vulnerability; and the efficacy of the recommended response lead to perceived response efficacy (Milne et al., 2000). Hence, according to the model, the components of fear appeal initiate mediating progresses, leading to protection motivation that might lead to an attitude change (expressed as an intention to adopt the recommended response). This construct emphasizes Rogers' argument that an attitude change is based on cognitive processes and protection motivation rather than fear as an emotional state (Rogers, 1975). The revised PMT from 1983 included a broader spectrum of factors to initiate cognitive processes, and established the following as the main components of the theory:

Perceived Severity refers to the one's belief regarding the seriousness of the threat's consequences to one's life; *Perceived Vulnerability* measures how personally sensitive an individual feels to the communicated threat (for example: the probability for one to contract the disease); *Perceived Response Efficacy* refers to beliefs about the effectiveness of the recommended coping response in reducing threat to the individual and avoiding the negative consequences; *Perceived Self Efficacy* refers to one's beliefs in his/he own ability to perform the recommended coping response; *Perceived Costs* and *Perceived Benefits* concern beliefs about how costly or how rewarding performing the recommended behavior will be to the individual. These components are divided into two groups of *threat appraisal*, including severity, vulnerability and benefits, and *coping appraisal,* including self-efficacy, response efficacy and costs (Pechmann et al., 2003). These processes involve evaluations of fear appeal components: components that are relevant to one's perceived threat in the threat appraisal process, and components relevant to one's assessment of the recommended coping response to the appraised threat in the coping appraisal process (Milne et al., 2000). The six cognitions described above determine the establishment of two more components: *Protection Motivation*, which is the Key factor of the relationship between behavior, threat and coping appraisal, and determines whether a person would perform the recommended behavior; and *Protective Behavior,* which stands for the performance of the recommended behavior (Boer and

Seydel, 1996; Milne et al., 2000). The theory suggests that protection motivation, which reflects the intention to perform a recommended behavior, is a result of both appraisal processes. Moreover, a positive relation lies between protection motivation and perceived severity, vulnerability, response efficacy and self-efficacy; a negative relation lies between protection motivation and perceived costs or perceived benefits in case of not adopting the recommended behavior (Conner & Sparks, 2005). Rippetoe and Rogers (1987) emphasizes the necessity for both sub-procceses to occur. They argue that threat-appraisal on its own is necessary but not a sufficient condition for the theory, as motivating people to protect themselves in an adaptive way requires the results of a coping appraisal process as well. This argument was supported in a meta-analysis by Floyd et al. (2000). They argue that the decision to take a protective action is a positive function of the threat appraisals of perceived severity and vulnerability, and that these considerations must be stronger than the perceived benefits if the action is not taken. They argue that it is the threat appraisal that generates the motivation to initiate coping process. Then, the decision for adopting the recommended response depends on whether one believes that performing the response will avoid the danger and that one has the ability and will to perform it. These coping considerations must be stronger than the perceived costs.

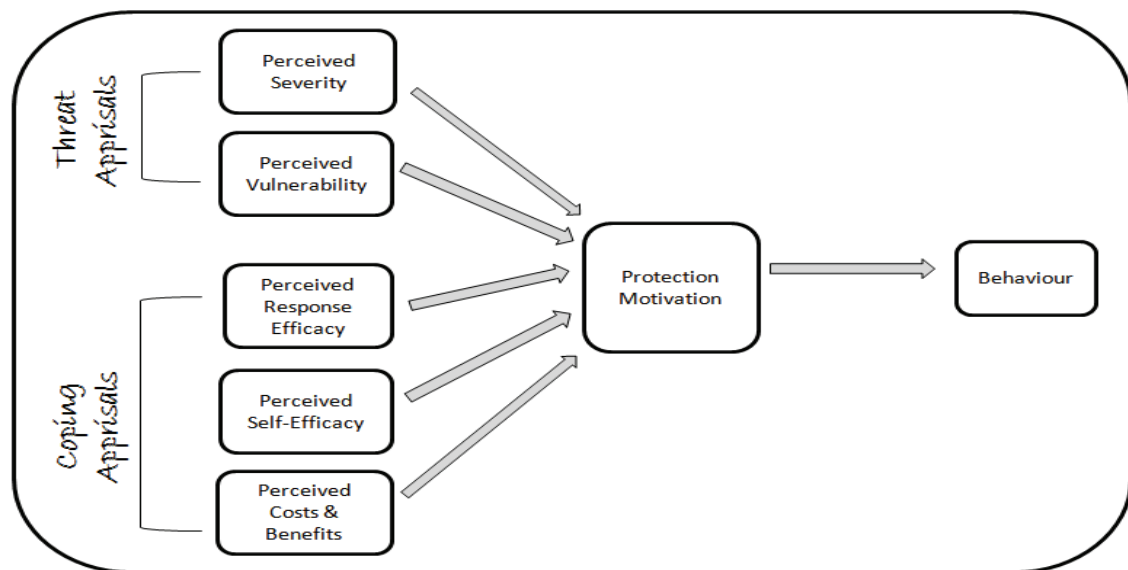Figure 6 presents the revised model components.

Figure 6: *Protection-Motivation Theory*

Application

   Protection motivation theory has been applied to various types of threats, however, its main domain of application is health which put much focus on understanding and predicting a protective health behavior. For example, the model was used to investigate the effectiveness of communication strategies for disease prevention. A study by Rippetoe and Rogers (1987) investigated how people cope with a threat when they do not plan to adopt a protective response. Their study examined the effects of information regarding the health threat of breast cancer and two aspects of coping ability: self-efficacy and response efficacy, on coping strategies. The study included 153 female students. 17 of them were assigned to the control group. The participants received written, persuasive information of the threat, the response efficacy and self-efficacy, and instructions for performing breast self- examination (BSE). Their results showed that threatening communication energized all forms of coping. Moreover, coping information was the most important factor for determining specific strategy choice, and self-efficacy had a significant relation with coping. Hence, the stronger people believed in their own ability to perform the recommended behavior, the higher was their intention to perform it and engage in a rational problem-solving approach. The authors found both threat appraisal and coping appraisal processes as necessary contributors for raising the intentions for a risk-reducing behavior, which in this study was the intention to adopt a BSE as a regular health habit: Both high response-efficacy and self-efficacy resulted in stronger intentions to perform BSE and a stronger belief in a rational problem-solving approach to the threat compared to a low response efficacy; however, a low response-efficacy resulted in higher relation to maladaptive coping strategies of fatalism and religious faith, and a low self-efficacy lead to significantly higher feelings of hopelessness in coping with the threat. Hence, people's high belief in their ability to perform the recommended behavior leads to higher intention to engage in this behavior and the use of a rational problem-solving approach, whereas a perception of a coping response as ineffective leads an engagement in some form of acceptance- philosophical (fatalism) or spiritual (religious faith).

   A meta-analysis conducted by Milne et al. (2000) examined the associations between the model components. They found that the model's variables were significantly

associated with concurrent behavior; in particular, the relation between intention and concurrent behavior which was the strongest. Moreover, intention had a medium-to-strong relation with subsequent behavior. They found that both threat-appraisal and coping appraisal variables had significant association with intention; however, the associations between coping-appraisal and intention were stronger than the threat-appraisal and overall the authors found threat appraisal to be a poor predictor of intention and behavior.

Plotnikoff, Trinh, Courneya, Karunamuni and Sigal (2009) used the theory for predicting aerobic physical activity and resistance training in a population of 244 individuals with type-2 diabetes. Their results showed general support of the theoretical structure of the PMT. In particular, coping appraisal variables such as self-efficacy and response efficacy were strong predictors of aerobic and resistance training intention and behaviour. However, other findings were not consistent with the model and raised questions regarding its effectiveness for the study: aerobic and resistance training intentions did not have a direct impact on behaviour, and therefore did not mediate the relationships between the threat, coping variables and behaviour; moreover, none of the unique constructs of the PMT (such as perceived vulnerability, severity and fear) had significant relations with either aerobic or resistance training intention. Therefore, the authors suggested that other social cognitive models may be more effective in predicting physical activity behaviour in such population.

PMT has been applied on food choices as well. For example, Cox, Koster and Russell (2004) examined the prediction of intentions to consume functional foods (i.e. foods which 'provide additional health benefits over and above normal nutritional values', p.57) and supplements that may improve memory. The study included 290 middle- aged participants who completed a questionnaire on experienced midlife symptoms, including memory loss. Finding a suitable theory to predict the intention to consume these products was one of the main objectives of the study, and the authors found a general high consistency within the PMT's constructs. The coping appraisals response efficacy and self-efficacy were found as the most important predictors of intention to consume the products: response efficacy was the main predictor, especially when the prediction was product- specific and self-efficacy was found as a condition for the intention to adopt that

behaviour. Relating to threat appraisal processes, vulnerability was a minor, though significant, predictor of variation in consumption intention. Furthermore, the results showed differences in consumption intention based on gender differences and products. For example, the study found low intentions to consume genetically modified products, especially for women.

2.4 Summary

The theories show the relationships between variables that lead to the intention to perform a behaviour, and each theory brings unique components that are the heart of its argument. For the theory of planned behaviour, it is the three main components of attitudes, social norms and perceived behaviour control, and the according beliefs that lead to their establishment; for norm activation model it is the awareness of consequences and ascription of responsibility that establish personal norms; and for protection motivation theory it is both threat appraisals and coping appraisals that establish a protection motivation.

Though each of the theories accounts for its unique approach, some similarities can be found between the components. For example, PBC, a variable of TPB, has a lot in common with the coping appraisals of PMT. Both components relate to one's perception of the ability to execute the behaviour in question and also account for external factors that might facilitate or inhibit this execution. Moreover, self-efficacy which is one of the coping appraisals is also one of the factors included in PBC. However, a difference between them can be attributed to the main focus of each component: in addition to self-efficacy, coping appraisals emphasize the conditions that might inhibit the behaviour in relation to one's perception of how effective the behaviour would be as a specific protective behaviour, and accounts for personal costs and rewards (benefits) attributed to the behaviour performance. Of course, this has to do with the theory's general focus on protective behaviours. However, for PBC, additional factors to self-efficacy are situational factors such as accessibility and availability that might create a difficulty in performing the behaviour.

In practice, the theories have been used with different extents of integration, whether it is the use of a model that combines several theories or a model that adopt specific components of one theory as additional to another model which is the main

theory of a study. For example, accounting for TPB components of social norms and institutional constrains (which can be related to PBC) in NAM (Jackson, 2005). Hunecke et al. (2001) examined the interaction between ecological norms and external aspects of travel mode choice. Their model included NAM, with the additional components of social norms and PBC (the latter was considered both as a direct influence on behavior, and indirectly- through intentions). Furthermore, external factors were considered as potential influence on the relation between the personal ecological norm and the environmental behavior. Furthermore, Harland, Staats and Wilke (1999) investigated the contribution of personal norms to the intention and performance of an environmentally relevant behavior, using an integrated model of personal norms and the theory of planned behavior. Their study included 305 Dutch citizens who were assigned to participate in a behavioral change intervention program on environmentally relevant behavior, and was expected to have a higher level of involvement with such behavior than the general public. Five behaviors were chosen: using unbleached (instead of bleached) paper; reducing meat consumption; using other transport modes than the car for short distances; using energy-saving light bulbs; and turning off the faucet while during teeth brushing. Attitude and PBC were found as the strongest contributors to intention, except in the case of consumption of meat. The authors argue that the addition of personal norm contributed to the study in several ways. For example, it independently contributed to the intention to perform each behavior, its addition lead to a decreased effect of attitude on intention, and it increased the explained variance of the intentions by 1-10%. Furthermore, the authors examined their assumption for differences between the determinants that explain intention for a future behavior and the determinants that explain past behavior. The behaviours were examined for this purpose except for the behavior of reducing meat consumption. This was excluded because the authors found the behavioral measure of decreased consumption (and not consumption per-se) to be potentially unreliable. Their results showed that that not only personal norm added significantly to the explanation of all four past behaviors, but it was also the strongest contributor, and its inclusion caused a considerable decrease in the contribution of attitude, subjective norm, and PBC. They conclude that personal norms are of importance in the environmental behavior domain as

they argue that decisions to behave pro/environmentally are partly based on moral considerations.

For the current topic, the unique components of the theories are assumed to have much importance for influencing reduction of meat consumption in Norway. The behaviour of meat consumption is related to one's moral, values and attitude; it can be considered a social or cultural behaviour; it is a behaviour that generates environmental impact; and it is related to health threats. Hence, each of the theories might contribute to the understanding of meat consumption in Norway, and to finding the facilitators and barriers for its reduction. Hence, TPB can emphasize the influence of pro- environmental attitudes, social pressure (including cultural influence) towards meat eating and the effect of self-efficacy and situational factors such as availability of vegetarian food, with reducing meat consumption; NAM might explain the behaviour in regards to ethics and morals. Moreover, since the environment is a common element, taking action to reduce environmental impacts can be seen as an altruistic behaviour; PMT can explain the motivation for the behaviour in regards to the reduction of personal health risks. More specifically, TPB is relevant for the current study due to its wide application in the environmental domain and its application for diet change. Furthermore, the variables this theory includes are of much importance for the topic of meat consumption. Increasing awareness towards environmental might affect environmental beliefs and attitudes and hence hold a potential for behavior change; Social norms might have a crucial effect on meat consumption as both eating and consumption habits can be considered social activities and are highly concerned with social factors (Gossard & York, 2003); PBC plays an important part here especially because eating is a basic, every-day activity, and therefore factors that imply difficulties on the behavior might be crucial for the decision of executing a behavior change as well as its preservation. NAM is of much relevance as it is widely applied to pro-social and pro-environmental behaviors (De Groot & Steg, 2009). The topic of environmental concerns in general, and meat consumption in particular, is highly connected to matters of moral issues, values and even altruism. Though motivations for the reduction of meat consumption might involve personal benefit (for example, health benefits), other motivations for this behavior change. Such motivations include environmental concerns, the engagement in animal rights and human

rights, considerate consumption and sustainability. Since personal norms were found as an important construct for pro-environmental behavior (Harland et al., 2007) and with a strong affiliation with moral values, this variable may be expected to be of a significant importance for the topic of meat consumption. A particular area of interest is Stern's development of the three types of values relevant to environmentalism ("value orientations"): self-interest, altruism towards other humans, and altruism towards other species and the biosphere (Stern et al. 1999). Protection motivation theory is relevant for this thesis both because of the health aspect involved in a diet change in general and regarding reduction of meat in particular, and because the applicability of the model to topics that are beyond the health domain. Though studies vary in their conclusions regarding the extent of health threat attributed to meat consumption, the debate regarding meat's effect on health is well recognized, and substantial amount of studies affiliate meat consumption with health threats such as heart diseases, colon cancer, colorectal cancer, breast cancer, prostate cancer (for example Ferguson 2002; Fraser, 1999). Applying the model to the environmental domain a threat might be personal, social or even universal. For example, air pollution generated from the meat industry might affect one on a personal level or on a community level etc., land degradation might put the threat on other society that oneself and biodiversity loss puts a threat in a biosphere level. Furthermore, severity, vulnerability, self-efficacy, response efficacy, response cost and response benefits are expected to be of much focus for examining the behavior of meat consumption and for planning successful interventions for is reduction.

2.5 Hypothesis

Based on the theories described and the assumptions of the factors attributed to meat consumption, the hypothesis of the current study is that the main variables influence the reduction of meat consumption in Norway:

1. Intention to reduce meat consumption will have a direct effect on behaviour

2. Strong personal norms regarding animal rights and environmental impacts that include awareness of the consequences and ascribe responsibility to the individual would result in higher intention to reduce meat consumption.

2. PBC will affect behavior directly and indirectly (through intention). For the behavior in subject, relevant external factors such as accessibility and availability of non-meat

based products and media's advertisements will create barriers towards the behaviour. Hence, low availability and accessibility of products, and high amount of meat advertisements compared to non-meat advertisements might reduce PBC and eventually the intention to engage in the behaviour.

3. Social norms and culture are barriers to the behaviour. People who know others who reduce (or avoid) meat consumption, or perceive less social risks if they engage in the behaviour, will show higher intention to reduce meat consumption themselves than people who are not familiar with others who reduce meat consumption or expect a high social cost if they engage in the behaviour.

4. Health aspects, especially perceived severity, perceived vulnerability, and response efficacy will initiate a protection motivation that will lead to intention to reduce meat consumption.

5. Habits will influence the actual performance of reducing meat consumption.

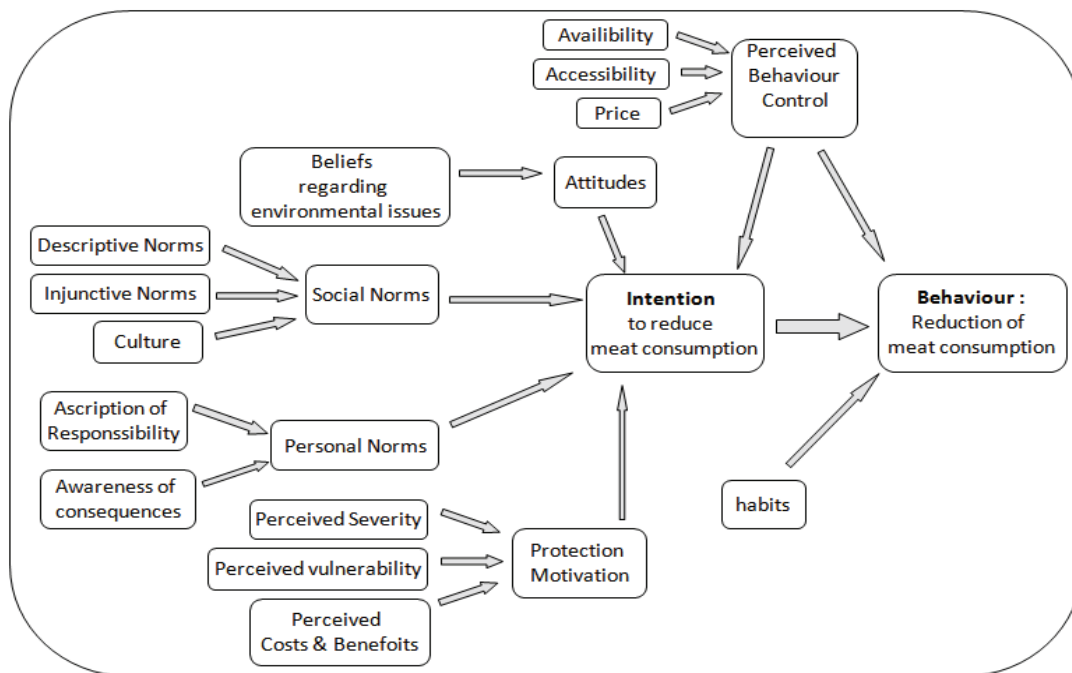Figure 7 illustrates the hypothesis with an assumed model.

Figure 7: *The assumed model for the current study*

The Following chapter describes the beliefs of moral issues, health aspects and environmental impacts that are associated with meat consumption.

3. REASONS TO REDUCE MEAT CONSUMPTION

Three considerations were chosen for this chapter to represent the main reasons to reduce meat consumption: moral aspects, environmental impacts, and health aspects. These considerations were chosen because they represent aspects attributed to both production and consumption of meat and account for the main actors that are involved in the meat industry. Moreover, they resemble findings of main considerations in food choices of former studies on related topics. For example, a study by Makatouni (2002) examined organic food consumption and found that health preservation, environmental protection and animal welfare were the most important values involved in its consumption. Stern, Dietz and Kalof (1993) argue that pro-environmental behaviour may derive from egoistic, social-altruistic, or biospheric value orientations. In the current context, egoistic value orientation can be assigned to health aspects; social-altruistic value orientation can be attributed to the moral aspects; and biospheric value orientation- to the environmental impacts of the behaviour. These three aspects of health, environment and moral considerations also represented vegetarianism benefits in a study by Kalof, Dietz, Stern and Guagnano (1999).

The following chapter gives an overview of the connection between meat consumption and each of the considerations. It is the fundamental fact that meat consumption is not an obligatory action, that brings the ethical question of whether this behaviour outweigh its moral, social, health and environmental costs.

3.1. Ethics and moral concerns

3.1.1 Animal Rights

Animals[3] are the main subjects of the meat industry. In 2010, more than 63.3 billion animals were slaughtered for meat production worldwide (Faostat, 2012). It is likely to assume that most people do not support animal abuse; however, every day people pay money to industries that are essentially based on animal suffering and exploitation.

This section gives an overview of the main arguments for animal rights, emphasizes the debate between animal rights and animal welfare, describes the conditions of animals in

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[3] For fluent reading purposes, the term 'animals' in this chapter refers to non-humans animals.

the Norwegian meat industry and briefly discusses the conflict between opposing animal abuse and supporting the meat industry.

The philosophy of animal rights

The philosophy of animal rights emphasizes that the interests of each individual, human or non-human, deserve equal consideration (Mathney, 2006). Francione (2000) argues that this philosophy is based on a rational argument: imposition suffering on any sentient being requires substantial moral justification, and pleasure, amusement or convenience are not regarded as such. He argues that since even "humane" animal agriculture involves substantial suffering that is imposed on conscious beings, and the justification for eating animal products is only based on pleasure, amusement, or convenience, therefore eating animal products cannot be morally justified. However, Francione (2012) argues that while logic and rationality are necessary, they are not sufficient to form a moral reasoning. He argues that in order to accept an argument for moral treatment of animals and an abolishment or regulation of animal exploitation, one must care morally about animals. Hence, one has to want to act morally with respect to animals, and feel these moral beliefs by wanting to do the right thing; only then, logic can be used to make compelling arguments that all conscious beings share a moral status and no animal exploitation can then be justified.

Animal rights philosophy includes several approaches. Singer (1990) focuses on the equality of suffering. He argues that the interest of animals, in particular the interest to avoid suffering, must be given equal consideration when weighing the consequences of an action for a judgment of whether it is right or wrong. Hence, the suffering of all individuals is equivalent, whether it is human individuals or not. Regan (2004) argues that animals have rights similarly to humans because, like humans, they are 'subjects- of- a- life', i.e. they are aware of the world and of what happens to them and what happens to them matters to them or to someone else. In other words, they have a life of their own that is of importance to them apart from their utility to humans (Regan, n.d.). Furthermore, he argues that at its fundamental level, human ethics is based on the independent value of the individual; hence, the moral value of a human individual is not measured by his/ her usefulness in promoting the interest of other human beings. Treating human beings differently is considered a violation of the most basic human right to be

treated with respect. Therefore, that the existence of one social group is not depended on its use to another: women do not exist to serve men, blacks to serve whites, the poor to serve the rich, the weak to serve the strong etc. He argues that the philosophy of animal rights accepts these truths, insists upon them and demands only that this logic is respected. Francione (2008) argues that the moral significance of animals can be linked to their sentience alone, because as such, it is their basic right not to be regarded as property.

Objectifying animals

The treatment of animals in the food, cloths, entertainment and research industries denies the essence of animals as conscious, sensitive beings and relates to them as objects, resources, commodities and products. Francione (2008) argues that this presents some form of a moral schizophrenia: on one hand, humans express care for animals through laws aiming at their protection; yet on the other hand, humans assign to animals the status of property, which implies that despite these laws, animals are no more than 'things'. Francoise (2012) emphasizes that human slavery has been rejected after the recognition that it places those who are enslaved outside the moral community entirely; it reduces them to things. Hence, if it is acknowledged that all humans should be included in the moral community, then all humans should be regarded as moral persons and not things, and an abolishment of slavery is required. Similarly, if animals are perceived as of moral value, then their status as property (or 'things') should be abolished and they should be treated as moral being. Hence, it requires from people to stop consuming them.

In order to be able to consume meat at an affordable price, human society approves methods of meat production that represses sentient animals in intolerable conditions for their entire lives. These animals are treated as machines that convert fodder into meat, and even brutal practices that might result in higher production rate are likely to be adopted (Singer, 1989). Regan (n.d.) argues that the difficulty with supporting the application of animal's rights and their independent value is that it would gives scientific and moral reasons to deny the common view of animals as exist to serve humans. Singer (1989) argues that for the great majority of people, especially in urban, industrialized societies, the most direct form of contact with members of other species is through eating them. Hence, animals are perceived as means to provide humans desires and please. He

argues that meat eating particularly emphasizes this perception as there is no defense for meat eating as obligatory for human nutritional needs.

Animal rights and human rights

Arguments for animal rights sometimes compare the situation of other animals to that of oppressed humans who did achieved recognition in their rights, even though such recognition was highly uncommon beforehand. Singer (1989) argues that a lesson learnt from past liberation struggles, such as the black liberation or women liberation, is that it is very difficult to be aware of hidden prejudice within an attitude towards a particular group until this prejudice is strongly pointed out. He argues that a liberation movement demands an expansion of one's moral considerations and perception of equality. Furthermore, he emphasizes that in order for one not to be regarded as an oppressor, even the most basic attitudes and their subsequent practices should be re-considered through the eyes of the most disadvantaged group who is affected by these attitudes and practices; this way practice might allow the reveal of patterns that benefit one group, which is often the group one belongs to at the expense of another. He argues that when Mary Wollstonecraft published her work on women rights in 1792, her ideas were broadly ridiculed and regarded as absurd. Moreover, a satirized publication by Thomas Taylor, a distinguished Cambridge philosopher, mocked her ideas. In order to contradict the acknowledgement in women's rights, he used an argument of the need to carry her ideas further and apply them to animals too. Slavery is a second example. Regan (2004) argues that the view of farm animals as legal property is often used as an argument for depriving rights from animals and leave them subjected to any treatment that is considered appropriate by the farmer, or 'the owner'. He points out that human- slaves were regarded similarly and up to the American Civil War they were not considered legal persons but property. He then argues that even though animals do not currently hold a status of legal beings, this does not mean they cannot or should not be viewed as such. Singer (1989) emphasizes that the decision to view animals as beings with rights involves a change of a social custom which currently supports the needs of the meat-industry. He argues that while one may perceive the decision to end this support difficult, such decision is not more difficult than it was for a white Southerner to go against familiar traditions and free his slaves.

Speciesism

The term is '*speciesism*' is often used within debates of animal rights. Sztybel (2006) argues that speciesism represents a parallel form to other intolerance forms such as racism, sexism, homophobia and ageism, on the basis that all of these involve harming or discriminating others for arbitrary and irrelevant characteristic such as skin color, sex, or species. While racists violate the principle of equality by favoring interests of members of their own race in case of a conflict between these interests and those of members of another race, speciesists act in the same way, but on species scale (Singer, 1989).

Singer (1989) emphasizes that humans are not all equal, as each person hold different characteristics of moral capacities, intellectual abilities, communication abilities, levels of sensitivity to the needs of others, capacities to experience pleasure and pain and so on. Hence, claiming equality based on actual equality of all human beings is irrelevant. In the same manner, he argues that though important differences exist between humans and other animals, these differences are not a barrier for extending the basic principle of equality to nonhuman animals. Moreover, these differences must be acknowledged and expressed through a relevant adjustment of rights for different beings.

Ignorance towards immoral treatment of animals

"The worst sin towards our fellow creatures is not to hate them, but to be indifferent to them: that's the essence of inhumanity" (George Bernard Shaw, 1901).

The conditions and treatment of animals have led many people to withdraw their support of the meat industry. This has been expressed in various ways: from basic avoidance of meat products to different extents of animal rights and animal welfare activism. However, vegetarians and vegans are still a minority and despite the moral aspects attributed to it, the meat industry is still within social consensus.

Williams (2008) argues that the lack of extensive public debate about animal use in factory farming can be partly explained by affected ignorance- the choice not to investigate whether a practice in which one participates in might be immoral, which she relates to as a dangerous phenomenon. She argues that affected ignorance can take various forms. For example, a refuse to acknowledge a connection between one's action and its consequence of suffering for another; a wish not to be informed of the nature of a suspected practice; not asking questions regarding a questionable practice; and

uncritically accept custom and ideological constructions. The latter is particularly common and often involves dogmatic rationalizations and unwillingness to acknowledge that majority opinions and common practices might be wrong or cruel. In the case of factory farming, she argues that many people choose to believe that the animals live well and enjoy their existence without the stress of life in the wild, while this is far from reality. She emphasizes that even though raising animals for mass food production has become a competitive business mostly managed by large corporations aiming at maximizing profit that allow production in low prices but high costs for the animals, yet the majority of people do not object either the methods or the outcomes of the industry. Moreover, social occasions that involve animal products, such as family meals, usually do not account for any debates regarding atrocious practices that might be included in the product making of the dishes on the table (Williams, 2008).

Williams (2008) points out several possible explanations for the lack of an extensive public debate regarding the moral status of animal treatments in the meat industry. These include moral apathy, intellectual laziness, preservation of self-interest, financial profit (or greed), and the convenience of conforming to status quo values and practices. Furthermore, supporters of factory farming might follow a view that considers a human interest in animal products to outweigh any relevant animal interest. Then, low prices of meat might be attractive enough to silence doubts about the moral issues attributed to it. Other explanations include a weak will that might lead a person to rather not debating the topic and keep consuming animal products despite their belief of the methods involved to be immoral; and one's fear of finding that one is participating in an immoral practice. She argues that many people do not want to acknowledge the details of the industry, and consider themselves ignorant about the moral issues associated with its practices.

Such consumers' passiveness is very convenient for the meat industry which puts effort in keeping their business out of consumers' debate. It takes some special effort for individuals to find the information regarding the treatment of animals as the industry operates with very little transparency. Dyrevernalliansen (2011a) argues that slaughterhouses commonly refuse filming and photographing as they do not want people to see how they operate. This is both because of the cruelty involved in the procedures and the repeating violations of the Animal Welfare Act. Furthermore, advertisements

promoting meat products might create a false image of the animals' life, for example by pictures of animals in the wild, and take away the worry for the animals, if such worry was initiated. However, while such argument takes off responsibility from individuals to investigate the issue, Williams (2008) emphasizes that though the meat industry is a powerful force that clearly rather sustain ignorance towards its practices, such ignorance is not an obligatory response. Instead, it is people's choice to ignore essential discussion on moral issues.

The treatment of animals in the meat industry- the case of Norway

The meat industry in Norway includes the slaughtering of more than 66.7 million animals per year. Counting for individuals, this includes 62,128,000 chickens, 1,142,000 turkeys, 154,000 ducks, 185,000 rabbits, 30,680 cows, 24,295 goats, 1,527 horses, 1,565,740 pigs and 1,203,820 sheep annually (Faostat, 2012). Dyrevernalliansen ('The Animal Alliance') (2003) argues that many Norwegians believe that the methods of animal farming in Norway greatly differ from those of the U.S. and the EU, and that the level of animal welfare in Norway is high due to smaller farms. But reality shows otherwise. Most of the animals in Norwegian livestock sector are not a part of small farms but bred in large herds, and the animals are usually confined year-round, except for cows and sheep that get to be outside for a few months a year.

It is not only the slaughtering itself that brings the moral issues of animal rights and welfare, but also the way animals are treated from birth till slaughter. Dyrevernalliansen (2004) argue that the high consumption of meat and the industry's wish for cutting costs lead to the application of severe practices on animals. These include infectious diseases due to extreme crowdedness; behavioural disorders as a result of being locked up in small spaces, deprived of needs such as moving normally, environmental stimuli and communication with other animals; intensive breeding, which involves organs modification for higher production and much stress. Moreover, transporting animals to slaughter involves stress, takes hours, and results in the death and injury of tens of thousands of animals annually due to weakness, sickness, fights and loading practices. Sometimes these transports continue to an overnight wait to be slaughtered.

The following section briefly describes the treatment of animals in the meat industry in Norway.

The *chicken*-meat industry is one of the most intensive livestock production sector in Norway. Most chickens are slaughtered at the age of just four weeks. Though so young, their body weight has been already reached the weight of almost twice as much as that of an adult chicken. Hence, their bodies are extensively modified to fit farmers' desire of higher production and profit. Such genetic modification leads to several painful results: the inability of their legs to carry the weight of the enlarged body can lead to paralysis, bone fractures and pain of stressed posture; their limited movement results in insufficient food and water supply that leads to kidney disorders, emaciation and dehydration and to death of starvation; acid burns are generated by chickens' lying on their enlarged heavy chests in puddles of urine and feces; and fluid accumulation in the abdomen occurs as the organs cannot keep up with the rapid body growth: the lungs cannot transport enough oxygen for the fast metabolism and the heart is not strong enough to pump blood through the overly large bodies (Martinsen, 2010a). According to the Norwegian Animal Welfare Act, one should not breed if the breeding change the genes of the animal, that has a negative impact on the animal's physical and mental functions or that passes on such genetic changes to future generations, that reduces the animals' ability to perform their natural behavior, or that arouse ethical reactions. However, as describes above, production ignores all of these criteria. Martinsen (2010a) argues that the law is set aside by political forces that rather give their attention to the sound of easy profits than that of suffering birds.

In order to avoid stress-induced behaviors, two main procedures are commonly used. One is keeping the chickens in semi-darkness. Hence, they witness sunlight only during transport to slaughter; the second includes cutting off the ends of their beaks, a procedure done without anesthesia, despite the high sensitivity of the organ (Bauston, 1996).

Chicken crowdedness in Norwegian farms can reach 24 chicks over $1m^2$, or up to 20,000 chicks under the same roof. Such breeding method is sometimes referred to as "free range" (Martinsen, 2010a). During the first few days, the chicks beep after a mother who will never come back, and then they become more quiet and passive. The reason for this change is debated: the passiveness might be attributed to the pain in their legs, the

difficulty to move around their bodies, or the difficulty to move because of crowdedness. After four weeks they are collected by machines or quickly by hand and driven away by transport trucks. It is estimated that about 80,000 chickens die and more than 400,000 are injured through the transport annually. At the slaughterhouse they are hung from their legs on an assembly line and electrocuted or gassed to death (Martinsen, 2010a). In cases where chickens escape this death (for example due to a smaller size than normal or a hanging posture that did not result in their electrocution, or that they got stunned but not killed by the gas), they might reach the slaughtering knife in conscious or be scorched off alive (Dyrevernalliansen, 2011).

Parallel practices are exhibited for the treatment of other animals raised for meat. *Pigs* are social, curious animals with high cognitive skills, including a great ability to understand their surroundings (Martinsen, 2010b). In the Norwegian pig meat industry, pigs are bred to have as many piglets as possible. Following the behaviour of pigs in the wild, a sow pig tries to build a nest before giving birth. However, as this mostly impossible to do in the industrial facility, this leads to much stress that sometimes results in her lying on top of the piglets, causing their death. About 15% of the piglets die of hunger, cold and poor immune systems within the first year of their lives. Despite the natural pattern of a mother pig to take care of her piglets for the first 4-6 months of their life, in the meat industry the piglets are suddenly taken away at the age of four weeks. However, even within the four weeks where the baby pigs are with their mother, there is not much room for maternal behavior or social contact. This is because it is common, and legal, in Norway to keep the mother pig in a crate while giving birth and for some time afterwards. Hence, she is kept in a tight metal frame without even the ability to turn her head; the only contact between her and the baby piglets is their suckling on her through the bars. The high number of piglets in each litter might lead to injuries through suckling; therefore, it is a common in Norway to file the piglets' juvenile canines. The pigs are usually raised in cramped, small concrete pens, without space to maintain basic natural activity. These conditions lead to various behaviour disorders of frustration, for example in the form of massive tail biting (Dyrevernalliansen, 2011). Adult female pigs, when not held in maternity crates, get about 2.5m^2 of space in a packed room. Their inability to move around results in much lying that in over 20% of female pigs causes bedsores and

deep wounds (Martinsen, 2010b). The pigs are bred to have an abnormally long back for a higher quantity of meat, and they develop problems in their legs which are weak from both the passive stand on concrete and the heavy body weight they carry (Martinsen, 2010c). 96% percent of the pigs have hoof disorders, and 85% of the piglets suffer from abnormal joints (Martinsen, 2010b). Moreover, the heavy body and the lack of sufficient amount of hey to cover the concrete floor cause bone disorders and pressure sores.

It is legal in Norway to use electric shocks to force pigs into the slaughter house. Killing methods include electrocution using electrodes attached to the heads and gassing with CO2 (Dyrevernalliansen, 2011), which may induce panic reaction (Martinsen, 2010c).

      Cows in Norway are confined to stalls for 8-9 months a year, with a very limited moving space that allows just a step forward, a step back and a turn of the head. Calves are usually taken away from the mothers immediately after they are born and kept alone in a box or with other calves (Dyravern Alliansen, 2011). 75% of Norwegian cows are used for both milk and meat production. Average Norwegian cows produce about 7000 liters of milk a year at the risk of diseases due to overload, yet not a drop is given for their own calf, which are with milk substitutes. The other 25% are bred for meat purposes only. They live in a small space that often includes slatted floors, where they can walk a few steps only and without any opportunity for natural behavior. This is often referred to as "free range" conditions.

In the slaughterhouse cows are led through hallways and kept in metal boxes before they are shot in the head (Martinsen, 2010c).

Animal rights versus Animal welfare

Two main approaches are held within the animal rights movement: animal rights and animal welfare. Though both rooted at caring for animals, they hold a fundamental difference.

Animal welfare argues for the need for regulations for animal treatment to reduce animal suffering (Francione, 2008). It refers to the conditions animals are held in and the practices applied on them. Advocates of animal welfare argue for changes in details such as the use of bigger cages, the cancellation of specific operations, the use of anesthetics for procedures, and so on. Hence, animal welfare is focused on providing better conditions to the animals that are used for human interests. While it might challenge the

industries that are involved in such use of animals, it does not demand their total cancellation.

The *Animal rights* approach argues that human beings have no moral right to use animals, regardless of their conditions of treatment (Francione, 2008); hence, it demands a more absolute outcome. Regan (n.d.) emphasizes that once it is acknowledged that animals do not exist to provide human needs, any injustice towards animals cannot be compromised. Therefore, "it is not larger, cleaner cages that justice demands in the case of animals used in science, for example, but empty cages: not "traditional" animal agriculture, but a complete end to all commerce in the flesh of dead animals; not "more humane" hunting and trapping, but the total eradication of these barbarous practices" (Regan, n.d.). Hence, it is not the details of the unjust exploitation that must be changed, but the unjust exploitation itself that must ended. Francione (2008) argues that if animals matter morally, then the principle of equal consideration should be applied on them; therefore, there is no justification to continue denying the right not to be treated as property to non-human animals, no matter how "humanly" they are treated. Francione advocates for the abolitionist approach which argues that all sentient beings have one right which is the basic right not to be treated as property; therefore, animal exploitation must be abolished, not regulated or institutionalized, because it assumes that animals are the property of humans (www.abolitionistapproach.com).

3.1.2 Human rights and risks:

Several violations of human rights are attributed to the meat industry, some of them occur in the agriculture industry in general. The following section discusses two main aspects concerning human rights that are particularly affiliated with the meat industry.

World hunger

Currently, there are about 925 million undernourished people in the world. Hunger and malnutrition are leading health risk worldwide, caused mainly by natural disasters, conflict, poverty, poor agricultural infrastructure and over-exploitation of the environment (WFP, 2012). About 98% of the world's hungry are in developing countries (FAO, 2012b).

The meat industry contributes to world hunger directly and indirectly. Its direct contribution referred to the distribution of available foods such as grains and cereals to the livestock sector, instead of using it as a nutrition source to millions of hungry people. Goodland (1997) argues that feeding grain and vegetables to people rather than to livestock will result in many more people being well fed and healthier, and at much lower environmental and social costs than through meat-based diets. He argues that food that is available in poor developing countries is currently imported to feed livestock that would be consumed by higher-income sectors of society in the developed countries. Virsenius (2001) argues that if livestock feeds that are edible to humans were consumed by humans and not by livestock, they would increase the amount of available nutrients to a greater amount of people. Therefore, not only this would improve people's health state as a result of a better nutrition, but it would also decrease food insecurity. Pimentel and Pimentel (2003) argue that the consumption of grain by livestock in the U.S. is more than seven times higher than the consumption by the total American population. Moreover, they argue that the amount of grains fed to livestock in the U.S. is sufficient to feed about 840 million people if following a plant-based diet. In a study from 1994, Kendall and Pimentel estimate that a world population of 7 billion people could be supported and maintain current levels of nutrition without increasing the rate of hunger level if following a vegetarian diet. While about 2500 kcal of food are needed for a vegetarian diet, this amount increases significantly to 9250 kcal if 30% of the diet is based on animal products. Hence, the latter requires a factor of 3.7 more edible calories to be grown or grazed to account for both livestock and human feed (Cohen, 1995).

An indirect contribution is through the effect of the meat industry on resource depletion and the acceleration of environmental degradation (further described in chapter 3.2). Pimentel and Pimentel (2003) argue that problems of food shortage and malnourishment are strongly related to the combined situation of rapid population growth and declining per capita availability of resources. The contribution of the meat industry to such decline is for example through the depletion of water sources, reduction of land fertility and desertification due to overgrazing.

Conflicts as a result of resource depletion

The contribution of the meat industry to human conflicts is another indirect effect, of its contribution to resource depletion. Homer-Dixon, Boutwell and Rathjens (1993) argue that environmental problems such as the growing scarcities of renewable resources can contribute to social instability and struggles. They argue that resource scarcity can be generated by humans in three main ways: a reduction of resource quantity or a degradation of its quality in a higher rate than its renewal, a result of changes in distribution patterns, and a result of population growth as the resource becomes shared to a greater amount of people. The first two reasons are associated with consequences of the meat industry. Furthermore, they argue that natural resource exploitation can weaken the power of governmental authorities and create opportunities for violent challenges by political and military antagonists.

Barnett and Adger (2007) point out four factors that affect violent conflicts and are influenced by environmental change. First is livelihood vulnerability. As people are exposed to risks such as degraded water quality and quantity, abundance of forest resources, and increased disease distribution, their vulnerability increases. The impacts are more significant in sectors of the population with high resource-dependency. Barnett and Adger (2010) emphasize that the extent of environmental stresses on individuals and societies are determined by both the level of dependence on natural resources and ecosystem services, and the capacity to adapt to changes of their provision. However, since all social-ecological systems are interdependent, none can be excluded from an influence of a global change. The Second factor is poverty and relative deprivation. For example, poverty can be generated directly from environmental change due a limited access to resources and an indirect influence through its effects on resource sectors. Third, environmental changes may decrease governments' ability to create opportunities and provide important services and freedoms for citizens. For example, due to increase costs of public infrastructure and services such as water supply and a decrease of state profit. The fourth factor is migration, as large-scale movements of people are related to an increased risk of conflict in the host communities. Environmental change might be a contributing parameter in migration decision when taken as a response to undermined livelihood conditions.

3.1.3 Eco-centrism

Eco-centrism emphasizes the value of nature and the environment as beings regardless of their utility to humans. It puts the biosphere in the heart of the consideration and hence represents an opposite approach to anthropocentrism (Dryzek, 2005). In relation to meat consumption, such approach challenges the ethics of the meat industry on two levels. On the physical level, it criticizes the industry for its severe actual impacts of this industry on components of the natural system as well as on the system as a whole. On a philosophical level, it examines the value of respect towards nature, which is a core principle in eco-centrism to avoid nature exploitation.

A main philosophy that supports eco-centrism is deep ecology. Deep ecology is based on two main principles. First is self realization, which refers to the identification with a larger self than the individual person. Hence, it suggests that one should be aware of the holistic organic system that one is a part of. The second principle is biocentric equality, which refers to the equality of those who are part of the ecosystem. It argues that no species, including the human species, is more valuable than another (Dryzek, 2005).

Another relevant philosophy is ecological citizenship, which implies that individuals should learn to become respectful citizens of an ecological space instead of altering ecological systems to suit their own interests (Dryzek, 2005).

Eco-centrism raises ethical questions for meat consumption through the environmental impacts and nature alteration initiated by the meat industry. These impacts are described in details in the next section.

3.2 environmental impacts of the meat industry

In 1997 Goodland stated that "raising livestock is more destructive in depleting topsoil, groundwater and energy resources than all other human activities combined, as well as causing enormous environmental damage, such as clearing of forests, destruction of wildlife habitat, and pollution of rivers and lakes" (p.7). 15 years later, the livestock sector has increased, and subsequently the magnitude of its environmental destruction increased as well. The environmental impacts are assigned not only to impacts generated as outputs of the meat industry but also to its resource demand. Furthermore, the meat

industry is often criticized for an inefficient wasteful conduct (Duchin, 2005; Gossard & York, 2003).

This section discusses the essence, the size and the causes of this destruction and presents the link between the meat industry and the environmental state. Considering the production and consumption of meat in a whole life cycle perspective includes all processes from feed production to waste disposal. These include crop production processes (such as seeding, fertilizing, harvesting drying and fodder preparation), transportation, feeding, slaughtering, storage, transporting, processing, retailing, preparation and waste disposal. Waste sources in meat production are extensive, including down-animals' corpses and inedible parts such as feathers, beaks, toes, hooves, hair, skin, excretions and blood. These make a significant threat for both terrestrial and aquatic ecosystems. The consumption phase of this industry adds processes and resource demands such as packaging, transportation, advertising and waste disposal. It should be noted that though the focus of this thesis is the meat industry, many estimations for environmental impact in this section refer to the livestock sector as a whole. This is because the industries included in the livestock sector (such as meat, dairy, eggs) are closely related and in many cases intertwined. For example, most of the cows in Norway are used for the production of both meat and milk, and cows feeding requirements are not estimated by production of meat and milk separately. Nevertheless, only estimations that refer to processes occurring in the meat industry are considered in this chapter.

This section describes the environmental impacts of the meat industry by the main environmental impact categories of land use, climate change and atmospheric emissions, water depletion and water pollution, and the threat on biodiversity. These categories are further used for a comparison between animal-based and plant-based diets. A summary concludes the chapter.

3.2.1 Land Use and Land degradation

The livestock sector is the largest of all anthropogenic land users. It accounts for about 78% of all agricultural land, 30% of the land surface of the planet and 33% of the cropland (FAO, 2006). Livestock affects land use through two main processes: grazing and the assignment of cropland to produce feedcrops.

The high magnitude of **grazing** includes a total global area of about 35 million km$^{2(4)}$.

Though herbivore grazing occurs also in the wild, most cases of overgrazing have been ascribed to grazing by domestic herbivores, which are usually kept at much higher densities than in the wild (Oesterheld, Sala & McNaughton, 1992). Bell, et al. (2011) argue that livestock grazing can generate several changes in soil surface physical properties. These include an increase of soil strength and bulk density, reduction of soil macro-porosity, hydraulic conductivity and infiltration rate. Such changes affect the water movement into and through the soil, and can increase runoff and sediment loss or affect the activity or the balance of soil biota, for example generating an increase in root diseases.

Severe cases of overgrazing cause soil erosion, which leads to the loss of its nutrients (Mysterud, 2006). Overgrazing occurs as a result of an imbalanced grazing that exceed the carrying capacity of a land. It prevents plant regrowth and therefore disrupts biomass revival. Some of the impacts give rise to positive feedback cycles that worsen damage to soils. For example the removal of a significant amount of plant cover by livestock, leads to a substantial amount of exposed soil that made vulnerable to erosion; erosion adds another difficulty on vegetation regrowth, perpetuates the lack of cover and generates additional erosion. This can also impose an environmental modification by non-native weedy plants that might outcompete the native ones (Withgott & Brennman, 2009). About 20% of the world's pastures and rangelands, including 73% of rangelands in dry areas, have been degraded to some extent, mostly through overgrazing, compaction and erosion created by livestock action (FAO, 2006).

Massive **crop agriculture** for producing feedcrops and fodder is an additional burden on lands .Feeding options vary by animal type, and mostly cereals, beans, peas, fishmeal, grass, silage, coarse fodder and pasture (Carlsson-Kanyama & Faist, 2000). Globally, 47.1 million km^2 are dedicated to the production of feedcrop, mainly corn and soy. Though most of this area is located in the OECD countries, some developing countries are rapidly expanding their feedcrop production, and a considerable part of this expansion results in clearing tropical forests (FAO, 2006).

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[4] Converted from 3,433 million hectares in the original report

Deforestation is especially severe in Latin America. For example, 70% of previously forested land in the Amazon is now occupied by pastures and much of the remainder area is covered by feedcrops. The rate of expansion of pastures into some of the most vulnerable and valuable ecosystems in tropical Latin America is estimated at 0.3 to 0.4% of forest lost to pastures annually. This expansion induces additional impacts to those of land, for example climate change and biodiversity loss (FAO, 2006).

3.2.2 Gaseous emissions

The livestock sector is an important actor in climate change, emitting substantial amounts of both greenhouse gasses (GHGs) and other substances to the atmosphere. FAO (2006) concluded the sector's contribution to be "enormous" (p.272), and estimated that it is responsible for 18% GHG emissions measured in CO_2 equivalents (CO_2-e). These emissions include 9% of all anthropogenic carbon dioxide emissions, 37% of anthropogenic methane, and 65% of anthropogenic nitrous oxide. To put in a broader perspective, this contribution of GHG emissions accounts for a higher share than the whole global transport sector. In addition, it is responsible for emitting 64% of anthropogenic ammonia emissions, which contribute significantly to acid rain and acidification and to eutrophication of ecosystems. In total, the livestock sector accounts for 35–40 % of global anthropogenic emissions (FAO, 2006).

Within the agriculture sector, livestock accounts for as much as 80% of the emissions. These are assigned to livestock production, including deforestation for grazing and feedcrop production, loss of soil carbon through grazing, energy used for growing feed, processing and transporting grains and meat, release of nitrous oxide through fertilizers, and emissions from animal manure and enteric fermentation (McMichael et al., 2007).

Greenhouse gasses (GHGs)

The estimations for GHG emissions generated from the livestock sector on a global scale vary on a wide range of 10% to 51%, where the FAO estimation is located at somewhat of the center of the debate (Nordgren, in press). These emissions include carbon dioxide, methane, and nitrous oxide.

The main contribution of *carbon dioxide (CO_2)* emissions from livestock derives from land-use changes, especially deforestation (FAO, 2006). An additional great source

for CO_2 emissions is the energy required for the sector's activity and its extensive use of fossil fuels. A study by Carlsson-Kanyama and Faist (2000) identified processes in the livestock sector and their energy demands. For example, they found that 0.26 to 0.40 MJ is required for 1kg of fodder ready for consumption, and 0.7 -3 MJ is used per kg carcass in cattle slaughter. Slaughtering was identified as a particular energy-consuming phase, for it includes cooling carcasses.

Within the livestock sector itself, the level of emission contribution varies; red meat is the most GHG-intensive than all other forms of food (followed by dairy products) (Weber & Matthews, 2008). For example, global estimations from 2002 include 1906, 514, 590 and 61 million tons of CO_2 from cattle, small ruminants, pigs and poultry, respectively (McMichael et al., 2007).

For animal based foods, non-carbon dioxide gases are argued to be more significant affecting climate change, as methane and nitrous oxide have a much greater near-term warming potential than carbon dioxide (Carlsson-Kanyama & González, 2009; McMichael et al., 2007).

Methane (CH$_4$) has a global warming potential that is 23 times higher than carbon dioxide's. Methane levels differ between animals used in the livestock sector. The main producers of extensive amounts of methane are cattle, buffalo, sheep, goats, and deer. A significant effect on climate change is generated when animals kept under domesticated conditions, as methane emissions grow higher with a higher feed intake (Carlsson-Kanyama & González, 2009).

Although methane warms the atmosphere much stronger than CO_2, its half-life in the atmosphere is only about 8 years, versus at least 100 years for CO_2. As a result, changes in methane amounts (and global warming in general) due to significant reduction or increase in livestock raised worldwide will be shown relatively quickly (Goodland & Anhang, 2009).

Nitrous oxide (N$_2$O) emissions from this sector account for about two-thirds of all anthropogenic N_2O emissions. This contribution is especially significant as N_2O is considered the most potent of the three major greenhouse gases, with a global warming potential that is 296 times higher than CO_2 (FAO, 2006). N_2O emissions from livestock

are generated from the manure breakdown when added to crops and pasture as fertilizer (FAO, 2012b).

Goodland and Anhang (2009) strongly disagree with the FAO's estimations for the livestock sector's contribution to GHGs. They argue that while FAO estimates the total contribution at about 18%, or 7,516 million metric tons per year of CO_2-e, their analysis shows that livestock and its byproducts actually account for at least 32,564 million tons of CO_2-e per year, or 51% of annual worldwide GHG emissions. They argue that the FAO's estimation only accounts for several contributing parameters of the livestock sector (including land use change such as clearing land to graze livestock and grow feed, keeping livestock alive, and processing and transporting the end products), yet an additional 25,048 million tons of CO_2-e generated from other categories of this sector have been undercounted or overlooked. One of these categories is CO_2 from livestock respiration which accounts for 21% of global anthropogenic GHGs. While the FAO excluded this process from its estimate for the argument of respiration being a part of a rapidly cycling biological system, the authors argue that livestock are a human invention and therefore a molecule of CO_2 exhaled by livestock is no more natural than one from a vehicle. Furthermore, they argue that a potential equilibrium of CO_2 between the amount respired by animals and the amount photosynthesized by plants has been disrupted by this sector itself as currently tens of billions more livestock are exhaling CO_2 than in preindustrial days, while Earth's photosynthetic capacity has declined sharply with increased deforestation rate.

Furthermore, the authors argue that the estimation for methane emission is higher if using a 20-year timeframe for this substance and not a 100-year timeframe as done by FAO. They find the 20-year timeframe more appropriate due to both the large effect that methane reductions can induce within 20 years and the severe climate disruption expected within 20 years without a significant reduction of GHGs. They emphasize that this timeframe is recommended for methane estimations also by the IPCC. Other sources for additional GHG emissions are generated from the increase of livestock size (due to the use of relatively old data and an its increase by 12% from 2002 to 2009), ignorance of the differences between processes and practices in different regions in global estimations (for example, FAO cites Minnesota as a rich source of data, though

operations taking place there are more efficient than those in most developing countries where the livestock sector is growing faster), and frequent undercounting in official statistics of pastoral and industrial livestock (Goodland & Anhang, 2009).

Non- GHG pollutants

Ammonia represents polluting gaseous emissions not linked to climate change. It is an important substance due to its severe potential for polluting ecosystems and affecting biodiversity by generating acid rain, acidification and eutrophication (see also section 2.3), in addition to odor disruption (FAO, 2006). Global anthropogenic atmospheric emissions of ammonia are estimated at about 47 million tons of nitrogen (Galloway et al., 2004), where 94% of this is produced by the agricultural sector. The livestock sector accounts for about 68% of the agriculture share (FAO, 2006). These high amounts of ammonia originate from animal feces and urine in the shape of urea, uric acid and undigested proteins (Groot Koerkamp et al., 1998).

3.2.3 Water pollution and water depletion

The Livestock sector is a key player for water depletion and pollution. With an increasing water use, it is estimated to account for over 8% of global human water use, particularly for raising feedcrops. Within the livestock sector, the most extensive amounts of water are used in the production of meat and dairy (FAO, 2006). Furthrmore, the 2006 UN report (FAO, 2006) stated that "It is probably the largest sectorial source of water pollution" (p.24), as it contributes to various problems such as eutrophication, dead zones in coastal areas, degradation of coral reefs, human health problems, and emergence of antibiotic resistance. The contribution to water pollution is through the release of nutrients, pathogens pesticides, antibiotics and heavy metals (Reijnders & Soret, 2003), and the main pollution sources are animal wastes, antibiotics, hormones, chemical substances, fertilizers and pesticides used for feedcrops, and sediments from eroded pastures (FAO, 2006).

The Livestock sector is estimated to be responsible for 32% and 33% of the nitrogen (N) and phosphorus (P) loads into freshwater resources, respectively. Additional sources for freshwater depletion by this sector are strongly connected to its impacts on lands, as grazing and hoof action generate soil compacting which affects water infiltration and the

speed of water movement across the landscape. Hence, soil compacting reduces the infiltration level, degrades the banks of watercourses, dries up floodplains and leads to lower water tables. Moreover, deforestation associated with livestock leads to increased runoff and a reduction of dry season flows (FAO, 2006).

Additional burden on water systems is generated by meat processing. This includes various procedures, depending on the animals used and the final product. FAO (2006) describes 9 processes as generic process for meat that affect water sources: delivery and holding of livestock, stunning and slaughter, hide removal, dehairing or defeathering, evisceration, trimming and carcass washing, boning, chilling, packaging and cold storage. Especially for the first 7 processes, not only water is a major input, but these also generate and waste which degrades water quality. This includes wastewater and additional waste products such as hide, feathers, hooves, heads and other body parts, blood and manure. Moreover, high water usage and wastewater generation are also the result of hygiene and quality requirements for food products.

From a management perspective, the impacts on water are crucial. Though pollution leads to severe impacts on ecosystems, the polluting process is often diffuse and gradual, therefore impacts are often not noticeable until much damage has been already done (FAO, 2006). This diffusion might also make the pollution process extremely hard to control.

Two main impacts on aquatic systems from anthropogenic contribution to carbon and nitrogen storage are acidification and eutrophication.

Acidification relates to the alteration of the seawater chemistry and can affect the physiology of marine organisms, for example by causing acid-base imbalance and reduced oxygen transport capacity (Fabry, Seibel, Feely, & Orr, 2008). Though acidification is a naturally occurring process, acceleration of its natural pace resulting from pollution of acidic or acidifying compounds rises much concern (Norton & Veselý, 2003). Subak (1999) argues that when generated by ammonia, acidification may be caused both directly, by affecting the vegetation around the source, and indirectly, trough nitrogen deposition.

Eutrophication relates to the result of extensive enrichment of water bodies with plant nutrients and precursors, such as nitrogen, phosphorus, and organic matter (Tusseau-

Vuillemin, 2001). Environmental impacts associated with eutrophication include the presence of toxins, hypoxic "dead zones", destruction of coral reefs, un-palatability of drinking water, extinction of native plants and biodiversity loss (Bennett, Carpenter, & Caraco, 2001).

A wide variety of sources in the livestock sector contribute to N and P loads, such as fertilizer runoff, manure storage systems, urine, combustion processes, organic material such as protein, lipids and dissolved nutrient concentrations generated from food processing, and corn and soybean farming systems that provide feedstock. An additional significant contribution is the process of animal slaughter. In fact, slaughterhouses account for the major source of N and P generated from the protein in the carcasses and blood that are included in their wastewater (Xue & Landis, 2010).

3.2.4 Biodiversity

Biodiversity loss is a natural process, and five waves of mass extinction occurred before human time. However, since humans' appearance on earth waves of extinctions followed their arrival on islands and continents and extinction became significantly higher (Withgott & Brennman, 2009). Since the 1950's, changes in biodiversity due to human activities became more than at any time in human history and scenarios suggest that these rates to continue or accelerate in the future (MEA, 2005). Hence, the modern era ("Quaternary period") might include the extinction of more than half of all species, caused by mankind (Withgott & Brennman, 2009). Current extinction rates are estimated at up to 1,000 times or more than natural rate (IUCN, 2011; MEA, 2005). These high rates lead to the emergence of an extinction crisis that displays nature's inability to support the current pressure that humanity is placing on the planet (IUCN, 2011).

Biodiversity loss is a gradual process, many times irreversible, that might be difficult to assess before it is too late. There are several threats to biodiversity and human activity is responsible for most of them (IUCN, 2011). While it is difficult to give an exact quantification of livestock-induced biodiversity loss (as losses are the result of a complex web of multi-level agents and changes, and current data collections do not include the entire range of livestock related processes), it is clear that the livestock sector plays a substantial role enhancing biodiversity loss, as it plays a significant role in all major threats on biodiversity (FAO, 2006). The main threats on biodiversity are:

1. Habitat changes, particularly from conversions to agriculture lands. IUCN (2011) estimates that h**abitat loss and degradation** account for 86% of all threatened birds, 86% of threatened mammals and 88% of threatened amphibians. Livestock account for about 20% of the total terrestrial animal biomass, and the 30% of the earth's land surface that is now used by the livestock sector used to be a wildlife habitat. An examples for the occupation of natural habitats by the livestock sector include the expansion of crop area into tropical forests such as in the case of Latin America, where most valuable ecosystems have been affected. Moreover, land degradation, also associated with the meat industry, affects biodiversity on all continents (FAO, 2006).

2. Overexploitation, and especially overfishing has been a dominant actor for changes in marine ecosystems (MEA, 2005). The livestock sector generates an increasingly strong impact by overfishing for animal feed (FAO, 2006).

3. Biotic exchange, including the spread of invasive species and diseases. These have been occurring in higher rates due to increased travel and globalization processes (MEA, 2005). An additional contribution assigned to the livestock sector because it is a driver and facilitator of invasive species (FAO, 2006).

4. Nutrient loading, particularly reactive nitrogen and phosphorus. In terrestrial eco-systems, especially temperate grasslands, shrub-lands, and forests, aerial deposition of reactive nitrogen are a direct cause for lower plant diversity; in aquatic ecosystems, the excessive levels frequently generate algal blooms and eutrophication (MEA, 2005). Industrial livestock production significantly effects nitrogen and phosphorus flows, and its generation of water pollution and ammonia emissions compromise biodiversity, often up to severe levels. Its impacts involve problems in both ends of the process as it accounts for depletion at the sources (land vegetation and soil) and pollution at the sink (disposal of animal wastes into waterways) (FAO, 2006).

5. Anthropogenic climate change.Climate change makes a strong impact on biodiversity and ecosystems, affecting species distributions, population sizes, the timing of reproduction or migration events, and increasing the frequency of pest and disease outbreaks (MEA, 2005). The significant contribution of livestock to climate change (as discussed in section 3.2) holds consequences for biodiversity (FAO, 2006).

Hence, the livestock sector may be the leading player in for biodiversity loss because it contributes to each of these threats. This is well expressed in various reports: 37% of ecological regions identified by the WWF account for livestock as one of the current threats; 23 of the 35 global hotspots for biodiversity identified by Conservation International are affected by livestock production; and IUCN's red list of threatened species reveals that most of the world's threatened species are experiencing habitat loss where livestock are involved (FAO, 2006).

3.2.5 Comparison: Environmental burden of animal-based and plant-based diets

There are several fundamental sources for inefficiency in animal products compared to plant based foods, due to the inclusion of plant foods production within the production of animal products. The first source of inefficiency regards to the is the use of feedcrops for the animal feed. Hence, not only the meat industry accounts responsibility for environmental impacts that result from meat production and animal husbandry processes, but also for background processes such as growing animal feed (Reijnders & Soret, 2003). Second, the conversion rate from animal feed to animal products is inefficient. For example, Whithgott and Brennanm (2009) estimate that 20 kg of feed are required to produce 1 kg edible beef, and 7.3 kg feed for 1 edible kg pork; Reijnders and Soret (2003) estimate that on average, 10 g of vegetable protein are used to generate 1 g of animal protein. Third, energy stored in foods is lost also through the transfer between trophic level, at a rate of up to 90%. For example, if grains fed to a cow eaten by a person, most of the grain's energy would be lost to the cow's metabolism (Whithgott & Brennanm, 2009).

This inefficient use of food sources becomes striking by the sheer amount of total food at stake. Goodland (1997) argued that people in OECD countries consume about 800 kg of grain indirectly, as much of it is inefficiently converted into animal flesh, and to dairy products. Pimentel and Pimentel (2003) compared the use of land and energy resources on an average American meat-based diet and a lacto-ovo-vegetarian diet, both accounting for about 3533 kcal per person per day. Even though their plant-based diet did include animal products of dairy and eggs, it already showed a significant lower land, energy and water requirements than the meat-based diet.

The following is a comparison of the environmental burden generated by animal-derived products and plant-based food, by the impact categories used before.

Land: In accordance with the mentioned above, the extent of land use is necessarily higher for meat production as it involves double- counting for both feedcrop growth and direct livestock use. In fact, it is widely recognized that a vegetarian diet consumes much less of the land (for example Duchin, 2005; FAO 2006; McMichael et al 2007; Pimentel & Pimentel, 2003; Reijnders & Soret, 2003).

As meat is considered a source for protein, it is of higher relevance to compare foods' efficiency of land use in relation to their protein content. In comparison to protein from soybeans, land requirements are about 6–17 times higher for protein from meat production (Reijnders & Soret, 2003). Similarly, Goodland (1997) argues that cereals can produce 2-10 times more protein, and legumes can produce 10-20 times more protein than the same area used for beef production (Goodland 1997).

Atmospheric emissions, climate change and GHGs: In a study of 20 food items in Sweden, Carlsson-Kanyama & González (2009) found animal products to generate higher GHG emissions than plant-based products, with the highest emissions occurring in meats from ruminants. Foods based on vegetables, cereals, and legumes were found to have the lowest GHG emissions. For animal products, GHG emissions ranged from 1.5 up to as high as 30 kg of CO2-e/kg of food, though only about 2.5 kg of CO2-e/kg product were usually found for fruits and vegetables, even if high degree of processing and substantial transportation was included (exceptions include products transported by plane). Moreover, a comparison of protein-rich foods included legumes, meat, fish, cheese, and eggs, and found differences with a factor of 30; the highest emissions were assigned to beef, cheese, and pork production (Carlsson-Kanyama & González, 2009).

The differences might be explained by the high amounts of methane and nitrous dioxide in the livestock industry, and the substantially higher use of energy in the production of animal relative to plant foods (Duchin 2005).

Pimentel and Pimentel (2003) argue that when balancing the inputs for different foods (fertilizers, fuel, agriculture machinery etc.) against their energy and protein content, grains and some legumes are produced more efficiently than animal products. Eshel and Martin (2006) argue that the GHG burden of animal-based foods in the collective diet in

the U.S. is about 1.485 ton CO2-e /person/year. They compared the edible energy in protein output with the fossil energy input, and found that the weighted mean efficiency of meat in American diet is 9.32%, while the energy efficiency of plant-based foods is for example 60% for tomatoes and 500% for oats. Accounting for a great variety in the use of fossil fuels between agricultural practices, Reijnders and Soret (2003) argue that fossil fuels' efficiency is estimated to be of a factor 2.5–50 better for vegetable proteins than it is for animal husbandry; for European countries, this difference will usually be a factor 6–20 to the advantage of soybean-based protein food. Compared by calories, beef is estimated to produce 16 times more GHGs than a mixed diet of vegetables and grains (Whithgott & Brennanm, 2009). Carlsson-Kanyama and González (2009) emphasize that changes toward a more plant-based diet could help substantially in mitigating GHGs emissions.

Water depletion and pollution: The production of meat is much more costly with regards to water use. Specific estimations of water requirements vary, as handing different animals in the livestock sector require different amounts of water. For example, the production of about 450 grams[5] of beef consumes over 10,200 liters[6] of water, while the production of about 450 grams[7] of grain requires less than 750 liters[8] of water, and about a half of that is needed for vegetables (Goodland, 1997). Reijnders and Soret (2003) estimated the difference in water requirements for meat protein and vegetable protein to be a factor of 4.4- 26 higher for meat production.

Pimentel and Pimentel (2003) argue that the production of 1 kg of animal protein requires about 100 times more water than 1 kg of grain protein. They reason this large difference in water by arguing that only about 1.3% of the total agriculture water is used directly by livestock. Moreover, they argue that water requirements increase dramatically for livestock production when feed crops of forage and grain are included. For example, producing 1 kg of fresh beef may require about 13 kg of grain and 30 kg of hay, and these require a substantial amount of water at about 37,550 litters, and on rangeland for forage production, more than 200,000 litters of water are required to produce 1 kg of beef.

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[5] Converted from 1 pound mentioned in the original paper
[6] Converted from 2700 gallons mentioned in the original paper
[7] Converted from 1 pound mentioned in the original paper
[8] Converted from 200 gallons mentioned in the original paper

Xue and Landis (2010) examined the nitrogen footprint of food groups and their eutrophication potential, considering the life cycle stages of farm production, food processing, packaging, and delivery. They found that on average, red meat has the highest eutrophication potential, followed by dairy products, chicken/eggs and fish. Considering the same amount of expenditure and energy content, cereal and carbohydrate were found to have the lowest nutrient footprint among all food subgroups, and identified as the most environmentally friendly choice for reducing nutrient emissions. Fruits and vegetables were found to have a minimal N-footprint. For example, the processes of producing, processing, transporting, and packaging 1 kg of red meat generates on average 150 g nitrogen-equivalent (N-e) emissions, while it is only about 2.6g N-e emissions are released to supply 1 kg of cereal. Similarly to land use, the authors explain that the extensive high rate of nutrient footprints of red meat and dairy products is due to their review under a whole life cycle perspective, which includes both direct and indirect emissions of the sector.

Other substances emissions with a potential impact on water quality and biodiversity are also higher for meat products: phosphorus input is estimated at 7 times higher, acidification potential at least 7 times higher, Biocides 6 times higher and heavy metals at least 100 times higher in meat-based protein than in soy-based vegetable protein (Reijnders & Soret, 2003).

Figure 8 provides a comparison between environmental impacts generated by the production of plant-based (soy) protein and animal-based protein. Meat based protein is found to generate higher impacts in all categories by a total factor of 6-100.
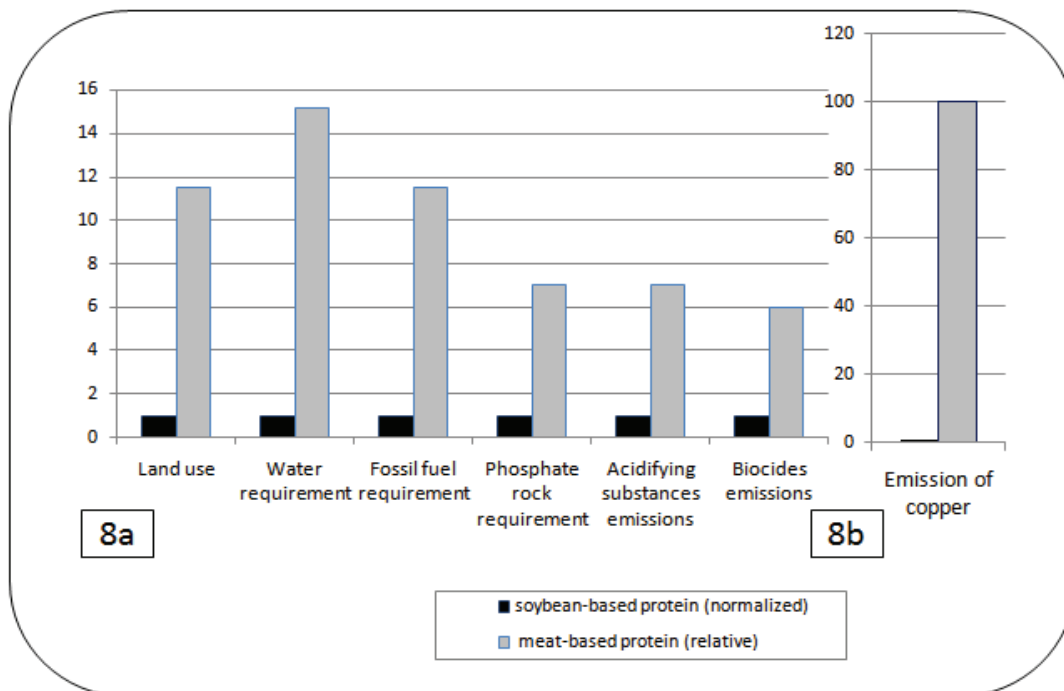
Figure 8: *Relative differences in environmental impacts of protein production: soybean and meat [soybean-based protein is given the value of 1].* *8a: resource requirements of land, water, fossil fuels, and phosphate, emissions of acidifying substances and biocides;* *8b: copper emissions. (Based on data from Reijnders& Soret, 2003).*

Biodiversity: Since a meat based diet imposes stronger impacts than a plant-based diet in all the main factors influencing biodiversity (habitat change, overexploitation, biotic exchange, nutrient loadings and climate change), its total impact on biodiversity stronger as well.

Also when considering a whole meal rather than a product comparison, studies find animal-based diet as generating stronger environmental impacts than a plant-based diet. For example, a study by Van der Pijl and Krutwagen (2001) compared two meals through a life cycle perspective: a conventional Dutch meal which included meat, and an average vegetarian meal of which the meat was replaced by a soybean protein. The overall environmental impact was about 1.5-2 times lower for the vegetarian meal (Reijnders &Soret, 2003); in another study by Carlsson-Kanyama and González (2009), GHG emissions generated from three possible meals in Sweden were assessed, focusing on their main ingredients. The meals included similar nutritional composition and showed

an overall span of a factor of 11 in GHG emissions: 0.42kg, 1.3kg and 4.7kg of CO_2-e, with the lowest emissions are assigned to the meal that did not include animal products. It should be noted that the components of each meal in this study differed by additional characters to the inclusion of animal products, such as preparation method and transport, that contribute to the difference in GHG emissions.

3.2.6 Summary

The livestock sector and the meat sector in particular generate substantial environmental burden. This chapter provided data on livestock's contribution to the main environmental impact categories and found it a major contributor to all of them. Overall, plant based diet in general, and protein production from legumes has much lower environmental impacts than animal-based diet or protein production based on animal products (Carlsson-Kanyama & González, 2009; Reijnders & Soret, 2003). This is mainly due to the longer supply chain of the animal-products that includes environmental impacts of both upstream and downstream processes (Weber & Matthews, 2008).

Figure 9 summarizes the main inputs and outputs in the meat industry that are relevant to environmental impacts. Double-counting due to the inclusion of direct and indirect requirements and impacts are clearly displayed.
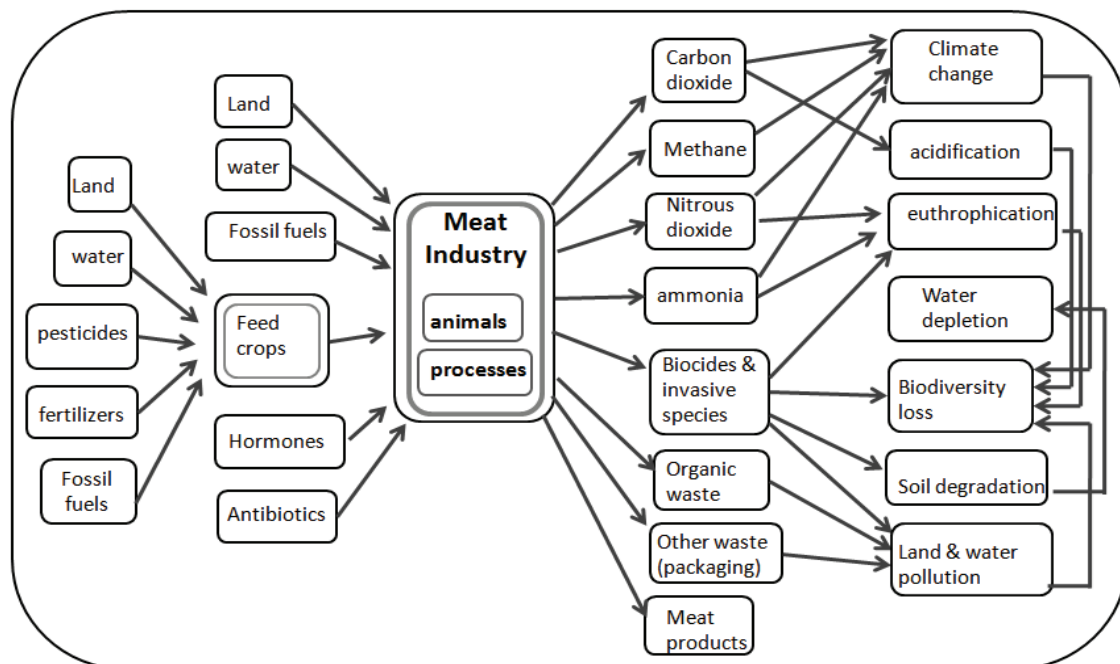

Figure 9: Inputs and outputs in the meat industry

It is important to note that additional burden might be generated from other life-cycle processes associated with meat production and consumption that might not be accounted for in different estimations. These include packaging, cooking methods, specific processing practices and differences in waste management systems. FAO (2006) argue that for waste, the problem is not only the amount of waste generated but also the physical distance between livestock production facilities and other facilities of the sector that creates inadequate conditions for proper waste management practices. These often result in soil and water pollution and GHG emissions.

Goodland and Anhang (2009), argue that several additional GHG sources are assigned particularly to the meat industry, though they do not take place directly in the meat production phase. The first source is the use of fluorocarbons which have a GWP up to several thousand times higher than that of CO_2. These are used for cooling livestock products, and are used in much higher magnitude than for plant-based foods. Second is cooking, as on average this process initiates higher temperatures and longer periods for meat than other foods. Moreover, in developing countries this process involves the use of large amounts of charcoal and kerosene, which add to the GHGs emission burden. Third, high amount of waste is generated from livestock products, including of liquid waste as well as bones, fat, and spoiled products. These are disposed in landfills, incinerators, and waterways, and contribute to GHGs. A fourth source relates to the impacts of livestock's by-products, such as leather, feathers, skin and fur. A fifth source includes the production, distribution, and disposal of packaging used for livestock products. Due to sanitary reasons, these are in much extensive use for livestock products than for its alternatives. The last source is the carbon-intensive medical treatment of millions of cases worldwide for diseases affiliated with livestock consumption, including zoonotic and chronic illnesses. They argue that since these diseases are strongly linked to livestock products, a full accounting of the sectors' contribution to GHGs should include portions of the construction and operation of pharmaceutical and medical industries used to treat these illnesses.

3.3 Health aspects

Nutrition plays a major part in one's health, and dietary factors are considered a main cause or prevention agents of important diseases (Willett, 1994). Sabaté (2003) argues that diets that are largely based on plant foods and contain no or very little meat, such as some vegetarian, Mediterranean, or Asian diets, are considered an adequate and optimal diet. Hence, they could best prevent both nutrient deficiencies and diet-related chronic diseases. While meat intake has been related to increased risk for a several chronic diseases, including ischemic heart disease and several types of cancer, a rich consumption of essential food components of the vegetarian diet such as fruit and vegetables, legumes, unrefined cereals and nuts has been attributed to generate a lower risk for many chronic diseases, and in some cases increased longevity. This argument is the basis for relating to meat consumption as a health threat and to its reduction as a health benefit, establishing a motivation of better health to reduce meat consumption.

This chapter provides an overview of health conditions associated with meat eating. It should be noted that a large amount of medical literature exists on the topic of diet and its health effects. As medical discussion is beyond the scope of this thesis, only a representative number of health conditions were chosen for this section, mainly based on their familiarity. Moreover, some studies do connect meat with health benefits; however these are not discussed here as they do not serve the purpose of this section.

Three types of diseases that are associated with meat consumption are presented: chronic diseases, zoonotic illnesses and indirect health hazards; these are followed by short discussions of a paradigm shift, the use of a plant-based diet as medical treatment and political barriers for its implication.

3.3.1 Illnesses attributed to meat consumption

3.2.1.1 Chronic diseases

Various chronic diseases and health concerns are mentioned in literature for their relation to meat eating. These include heart diseases, various types of cancer, Crohn disease, obesity, diabetes, rheumatoid arthritis and rheumatism.

Cancer

Cancer is one of the leading causes of death globally. The world health organization (WHO) predicts that deaths from cancer will continue to rise, and estimate 13.1 million

death cases in 2030. It argues that about 30% of cancer deaths occur due to five leading behavioral and dietary risks, two of which are diet associated: high body mass index, low fruit and vegetable intake, lack of physical activity, tobacco, and alcohol (WHO, 2012a).

Different types of cancer are attributed to meat consumption, and human epidemiological evidence supports the link between animal based diet and cancer (Eshel & Martin, 2006). Sieri et al. (2002) conducted a study assessing the relation between diet and *breast cancer*. The study included a semi-quantitative self-administrated food questionnaire, completed by 4,053 healthy postmenopausal women, between the ages of 41–70 from Northern Italy. They found a significant positive correlation between total fat and animal protein and the risk of breast cancer, with the main sources of animal protein in this study being meat and cheese. They concluded that diet rich in animal protein and fat can be associated with increased breast cancer risk. Moreover, their international comparison of cancer occurrence and dietary habits suggested a relation between animal protein consumption and incidence and mortality rates for both breast cancer and other hormone-related cancers.

Chao et al. (2005) found positive associations between the consumption of processed meat and a risk of distal *colon cancer*; high consumption of red meat and the risk of *rectal cancer*, and prolonged high consumption of red and processed meat and the risk of *cancer in the distal portion of the large intestine*. Their study included 148,610 adults of 50-74 years old who provided information on their meat consumption in 1982, 1992/1993 and 2001. Their distinction of red meat included various products such as bacon, sausage, hamburgers, meatloaf, beef, chicken liver, pork, hot dogs and salami and others.

Fraser (1999) compared the extent of chronic diseases for different dietary patterns within the Seventh-day Adventist group. About 50 % of the participants in the study ate meat products once a week or not at all, and most Seventh-day Adventists do not smoke cigarettes or drink alcohol. The vegetarian diet in this study was not a low-fat diet; therefore the difference between the groups was in the type of fat that was consumed. Vegetarians were found to have lower risks of obesity, hypertension, diabetes, arthritis, colon cancer, prostate cancer, fatal IHD in males, and death from all causes. *Colon cancer* and *prostate cancer* were significantly more likely in non-vegetarians (88% and 54% greater, respectively), and it was both red and white meat consumption associated

with the increased risk of colon cancer; a higher risk of ***bladder cancer*** was assigned to frequent beef consumers. On the other hand, higher consumption of fruits or dried fruits was associated with lower risks of lung, prostate, and pancreatic cancers, and the intake of legumes was negatively associated with risk of both colon and pancreatic cancer.

Heart diseases

According to the WHO, Cardio-Vascular Diseases (CVDs) are the leading cause of death worldwide. Moreover, it estimates that the number of death by CVDs will reach almost 23.6 million by 2030 (WHO, 2011a).

Bernstein et al (2010) examined the relation between Coronary Heart diseases (CHD) and foods that are accounted for major protein sources, through a 26-year follow-up study. Data regarding the participants' diet was collected by questionnaire every 4 years. They found a significant association between higher consumption of processed and un-processed red meat (and high-fat dairy products) and an increased risk of CHD. Moreover, comparing between the effects of one serving per day of nuts versus red meat, the nuts were associated with a 30% lower risk of CHD.

A systematic review and meta-analysis of evidence for relationships between processed and un-processed red meat and total meat consumption with incident CHD, stroke, and diabetes mellitus was conducted by Micha, Wallace and Mozaffarian (2010). Their analysis included the total amount of cases from 1,218,380 individuals. They found an association between processed meat consumption and higher risks of both CHD (42% higher) and diabetes (19% higher), per 50-g serving per day.

In his study within the seventh day Adventists mentioned above, Fraser (1999) found significant associations between beef consumption and fatal ischemic heart disease (IHD) in men, as well as a 37% reduction in lifetime risk of Ischemic Heart Disease (IHD) in vegetarian males compared with non-vegetarians. A previous study within the seventh day Adventists group was held by Snowdon, Phillips and Fraser (1984), including 25,153 participants from California between the ages of 30-84. Their study showed a substantially higher risk of fatal IHD for meat consuming participants than vegetarians, especially among young men. Moreover, the predicted relative risk of fatal IHD was 70% and 37% higher for men and women, respectively, between participants who consumed meat daily and those who did not.

Gramenzi et al. (1990) conducted a 5-years case-control study to examine the relation between selected foods and acute myocardial infarction in women. Their study included participants from 30 hospitals with coronary care units in northern Italy and took place between 1983 and 1988. They found a direct association between the frequency of meat consumption and acute myocardial infarction. Women who consumed ham and salami more than twice a week had a significant 60% increased chance for a myocardial infarction. Another study from 2009 by Sinha, Cross, Graubard, Leitzmann and Schatzkin (2010) found an association between meat consumption and an increased risk of CVD mortality. This study included a follow up of 10 years for 322,263 men and 223,390 women and showed an increased risk of cardiovascular mortality among women consuming high intakes of red and processed meats (Sinha, 2010).

Finally, Johnston (2009) argues that an effective dietary strategy for reducing the risk of cardiovascular disease is to consume less arachidonic acid. This can be achieved by reducing the consumption of beef, poultry, fish, and eggs from the diet.

Other Chronic Diseases

The extent of ***Diabetes*** is very high. The WHO (2011b) reports that in 2011 about 346 million people worldwide had diabetes, and projects diabetes deaths to double between 2005 and 2030. Barnard, Katcher, Jenkins, Cohen and Turner-McGrievy (2009) argue that dietary factors and obesity are the key players for the risk of developing type 2 diabetes, and nutritional changes are a main tool for disease management (Barnard et al, 2009). They argue that "vegetarian and vegan diets offer significant benefits for diabetes management" (p.255). They found that not only low-fat vegan diets are at least as effective as conventional diabetes diets aimed for weight reduction and glycemic control, but they are also substantially more effective for lipid management. They found that vegetarians are about half less likely to develop diabetes than non-vegetarians. Furthermore, for patients with type 2 diabetes, low-fat vegan diets showed a greater improvement of glycemic control than conventional diabetes diets (see below). These effects are mainly a result of a greater weight loss; however, the authors argue that additional influences of plant-based diet on glycamia are the result of reduced intake of saturated fats and high-glycemic-index foods, increased intake of dietary fiber and vegetable protein, reduced lipid concentrations, and decreased iron stores. Furthermore,

they argue that vegetarian and vegan diets also improve plasma lipid concentrations and have been shown to reverse atherosclerosis progression.

A link between meat consumption and the risk for diabetes was found in the meta-analysis by Micha et al. (2010), described above. They found an association between a higher consumption of processed meat and increased risk for diabetes. Similar findings reported by Fretts et al. (2012) in a study within American Indians.

A clinical study by Barnard et al. (2006) compared the effect of diet on the change in glycemic control and cardiovascular risk factors for participants with type 2 diabetes. Two diets were compared: a diet based on the American Diabetes Association (ADA) guidelines, and a low-fat vegan diet, for a time period of 22 weeks. While both diets generated an improvement in glycemic and lipid control, the improvements were greater with the low-fat vegan diet. The authors affiliate these results with characteristics of the low-fat plant-based diet that influence nutrient intake and body composition, and these may affect insulin sensitivity. For example: a reduction in body weight is assigned to these diets as they typically contain low fat and are high in fiber. Therefore, the reduction of energy density and energy intake might not be fully compensated for by a higher food intake. Furthermore, they reason the improvement in cardiovascular risk factors (a primary cause of morbidity and mortality in diabetes) by stating that a vegan diet has the effect of lipid-lowering due to its absence of dietary cholesterol, its low saturated fat content, and a specific cholesterol-reduction effect of soluble fiber and other plant elements. Finally, they argue that diets high in refined carbohydrate may increase triglyceride concentrations; however, diets that include high-fiber and low–glycemic index foods cause the opposite result.

Fraser's (1999) study among the Seventh-day Adventists found vegetarians to have lower risks of diabetes, hypertension, and arthritis than non-vegetarians. Moreover, the extent of both ***hypertension*** and ***diabetes*** were greater for non-vegetarians, as well as the prevalence of ***rheumatoid arthritis*** and ***rheumatism,*** where the difference was almost 50% higher for non-vegetarians. These results were statistically significant, consistent for both sexes, and adjusted for age. Moreover, vegetarians were found to live longer. Finally, ***obesity*** increased with higher meat consumption. Overweight and obesity are the fifth leading risk for global deaths and are linked with chronic diseases such as diabetes,

ischemic heart disease and cancer. However, obesity is preventable (WHO, 2011c). Jacobs, Haddad, Lanou and Messina (2009) argue that studies consistently report lower body weights and body mass index for vegetarians in comparison with non-vegetarians.

Crohn disease, a chronic disease of the intestine has also been affiliated with meat consumption. A 19-year follow-up study was performed by Shoda et al. (1996) to examine the correlation between the incidence of Crohn disease and dietary change. The study took place between 1966 and 1985 and included Japanese participants. They found a strong correlation between increased incidence of Crohn disease and increased dietary intake of animal protein and milk. Furthermore, animal protein was the independent and strongest factor correlated with the increased incidence of the disease. Chiba et al. (2010) conducted a 2- year follow-up study in order to investigate whether a semi-vegetarian diet (SVD) has a preventive effect against relapse of Crohn's disease (CD) in patients who have achieved remission and are considered in a high risk for relapse. The study involved 22 patients and two groups of dietary patterns: SVD (which included a daily intake of rice, vegetables, and fruits, and an occasional intake of fish, meat, and other animal-based foods) and an omnivorous diet. The results showed that the SVD protected patients from relapse, however the omnivorous diet did not. The authors concluded that the SVD is highly effective in preventing relapse in Crohn disease. The authors find support for their findings in a pediatric study conducted in Canada by D'Souza et al. (2008). They concluded that specific dietary patterns could be associated with different rate of risks for CD in children. Furthermore, they reported a positive association with a western diet (meats, fatty foods, and desserts) and a negative association with a prudent diet (vegetables, fruits, olive oil, grains, and nuts).

One example for a potential health threat due to ***nutritional deficiency*** attributed to meat consumption is the case of calcium. Barnard, Nicholson and Howard (1995) argue that reduced meat consumption is associated with lower losses of calcium through urine. This, they argue, might be the reason for lower rates of hip fraction in plant-based diets in comparison to diets that incorporate animal products, and for general calcium adequacy in plant based diets.

It is important to note that the lower disease risk assigned to vegetarians might be a result of the lack of meat consumption, but also of the increased consumption of plant-

based foods that carries health benefits (Barnard et al., 1995; Fraser, 1999; Sabaté, 2003). Among the nutritional benefits of vegetables, fruit, grains, and nuts are phytosterols and unsaturated fats that lower the concentration of blood cholesterol; dietary fiber, which also lowers blood cholesterol and may additionally protect against colon cancer; antioxidant substances that may reduce the risk of heart disease and cancer (Fraser, 1999; Sabaté, 2003). In contrast, meat products do not contain dietary fiber; they often contain substantial amounts of cholesterol and saturated fats that raise the concentrations of LDL cholesterol; they do not contain substantial amounts of phytochemicals. Furthermore, some evidence shows that the process of heating and cooking meats may generate carcinogenic compounds (Fraser, 1999).

3.3.1.2 Zoonotic illnesses

Zoonotic illnesses are non-human animals' diseases transmitted to humans. The main way of transmit to humans is by exposure to infected animals or the consumption of infected animal parts. Hence, individuals who consume animal products are in a substantially higher risk of exposure to these diseases than those who do not.

Bovine Spongiform Encephalopathy (BSE), commonly known as ***Mad-Cow Disease***, is a fatal neurodegenerative disease in cattle, transmitted through the consumption of meat-and-bone meal from infected cattle (Harman & Silva, 2009). The transmission of the disease from cattle to humans occurs through eating meat from infected cattle. In humans, it is known as a variant of the ***Creutzfeldt–Jakob disease (CJD)***.This variant was recognized in the 1990's and was strongly linked to an exposure to BSE. In Comparison to other forms of CJD, the latter one tends to affect younger patients and has a longer duration. It is a fatal human neurodegenerative condition. Early symptoms include psychiatric or sensory symptoms such as depression, apathy or anxiety, and in some cases unusual persistent and painful sensory symptoms. Patients develop more and more neurological signs as the diseases progresses, including unsteadiness, difficulty of walking and involuntary movements; by the time of death, they become completely immobile and mute (WHO, 2012b).

Avian influenza (AI), commonly called ***Bird Flu***, is an infectious viral disease of birds, and its mutant H5N1, have caused serious infections in humans. Symptoms include high fever and other influenza-like symptoms, diarrhea, vomiting, abdominal pain, chest pain,

bleeding from the nose and gums, respiratory distress and sputum production. The primary risk factor for human infection is the exposure to infected live or dead poultry or to contaminated environments (WHO, 2011d). Another virus of the same family is the **Swine influenza** (**'Swine flu'**), which in 2009 reached a particularly quick, wide spread worldwide. Within one month after the identification of a new virus strand in Mexico (Trifonov, 2009), it spread to 43 countries and affected 12,515 reported cases and 91 associated deaths.

3.3.1.3 Indirect climate change effect

An additional substantial amount of health problems can be attributed to meat consumption indirectly through its contribution to global climate change. These include physical hazards, temperature extremes, changes in air quality, altered patterns of infectious diseases transmission and effects on food yields. Health risks affiliated with population displacement and conflicts are to be considered as well, for example as a result of food insecurity and desertification (McMichael et al., 2007). Health hazards attributed to the above include stress, mental health threats, nutrition deficiencies, and might also result in physical harm, Barnett et al. (2010) argue that effects on livelihood are among the factors that increase the risk of violent conflicts.

3.3.2 A Paradigm shift

Sabaté (2003) argues that epidemiologic, clinical, and basic science research on the health effects of several plant foods had induced an expended scientific understanding of their role on human health and nutrition. These recent scientific advances seem to have resulted in a *paradigm shift*: diets largely based on plant foods, such as well-balanced vegetarian diets, are growingly viewed as improving health than as causing disease, in contrast to meat based diets. Hence, he emphasizes that referring to plant-based diets as healthier than meat-based diets presents an important departure from previous views on dietary recommendations for the prevention of diseases. This as through the 1960's, it was widely agreed that following a vegetarian diet puts one at higher risk for developing nutrient deficiency diseases than if following a meat-based diet. However, it is now known that diets largely based on plant foods, such as well-balanced vegetarian diets, could best prevent nutrient deficiencies as well as diet-related chronic diseases.

Barnard et al. (1995) argue that while it was once believed that plant-based diets require much planning to ensure a substantial intake of protein, it is now known that a varied plant based diet provides protein requirements easily, even without an intentional combining of foods.

In a summary of conclusions drawn from a panel discussion of the plant-based food and vegetarianism in US dietary guidelines, Jacobs et al. (2009) argue that recommendations for increased plant food consumption and vegetarianism were raised in the context of improving the conditions of health and the environment.

They provide several arguments for a better presentation of plant-based and vegetarian eating patterns in the dietary guidelines: 1.the quality of plant-based diets as nutrient dense and calorically diluted is desired for the management of overweight and obesity, which are growingly considered responsible for substantial increases in morbidity and early mortality; 2. the association between plant-based and vegetarians diets with longevity and a lower chronic disease burden; 3. the high economic burden of animal food due to the additional costs of feed crops; 4. the substantial contribution of animal farming to climate change and GHG emissions in particular.

3.3.3. Diet as medical treatment and political barriers for Plant-based diets

Some studies find plant-based diet as treatment. Esselstyn (2010) puts a strong criticism on the common treatment for coronary artery diseases. He argues that the interventional and pharmaceutical treatment results in significant mortality, morbidity, and high financial costs, yet neither the procedures nor the drugs treat the cause for the disease. However, he claims that a lifestyle of plant-based nutrition provides a simple, far more effective, cost-effective, and sustainable treatment. In fact, his argument is largely based on his own experience of a successful treatment of patients through a diet change that resulted in the arrest and reversal of the disease. Hence, Esselstyn finds the western diet to be the real cause for coronary artery diseases. To support his argument, he points out that coronary artery diseases are absent in plant-based cultures such as rural China, Papua highlanders in New Guinea, central Africa, and the Tarahumara Indians of northern Mexico. Moreover, in such cultures that adopt the Western, animal-based nutrition, coronary artery disease was also developed. Another example refers to Norway. He argues that between 1939 and 1945, during World War II, the occupying German

forces deprived Norwegians of their livestock. Hence, a substantial diminish has occurred for animal-derived foods. Interestingly, during that same time, the rates of deaths from heart disease and stroke dropped significantly. Furthermore, within two years of meat and dairy consumption restoration after the war, death rates returned to the pre-war levels.

Esselstyn points a blaming finger at several mutually reinforcing institutional and commercial interests that oppose this lifestyle intervention. These interests, he argues, are for example behind the food pyramid issued by the United States Department of Agriculture which encourages millions of Americans to pursue food that generates cardiovascular disease. The profit makers include the pharmaceutical industry which takes in billions in profits from heart disease, including $21 billion from drugs annually. In a study from 1995, Barnard et al. estimated the medical costs attributed to the health effects of meat consumption by comparing the extent of hypertension, heart diseases, cancer, diabetes, gallstones, obesity and foodborne illness among meat eaters and vegetarians. They concluded that health care costs assigned to meat consumption are substantial. Acknowledging that individuals in these two diet groups might differ in many ways beyond diet (for example smoking, alcohol consumption and exercise), their data was based on studies that controlled for such effects when relevant. However, they emphasize that no adjustment for body weight was done as increased body weight is considered a part of the mechanism generating the above illnesses.

Nestle (1999) emphasized the power of politics over consumers' choices for food. She argues that although there is a consensus that eating more plant foods and less animal products would best promote one's health, the food system creates environmental barriers for choosing plant-based diets. These barriers are motivated by the competitive food market, where companies must continuously find ways to sell more of their more profitable products. This market does not only involve companies but also policy makers and governmental authorities. As an example for government's give in to corporate pressure, Nestle (2002) argues that the published "eating right pyramid" of 1991 was an altered version of the original pyramid which recommended higher meat consumption due to pressure from the meat industry.

4. METHOD

Sample

The final sample in this study was of 210 participants and the data collection took place in Trondheim. Overall, participant's age distribution was 15-59, the mean age was 25 years old (SD=7.56). The participants' age distribution is presented in figure 10. About 56.7% of the participants were females, 40.5% males and 2.9% did not wish to specify one of the above.
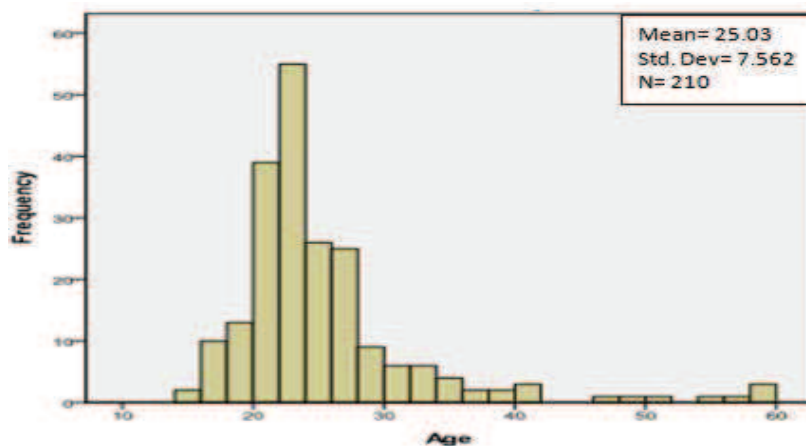

*Figure 10: Participants' a*ge distribution

Data was collected manually, approaching individuals in person and asking for their participation in the paper-pencil questionnaire. It took place on December, 2011. Since it was at the time of Norwegian winter, approaching random individuals outside was not an option, and indoor facilities had to be chosen. In order to acquire as varied a sample as possible, data collection took place in various locations in the city. These included two NTNU campuses- Gløshaugen and Dragvoll (approaching both students and staff members), the public library, coffee shops, restaurants, offices and social gatherings that were encountered by chance. About a third of the sample was collected outside the campus area. On average, filling the questionnaire took 10-15 minutes.

Questionnaire

The questionnaire was built with a focus on the 3 main theories formerly described: the Theory of planned behavior, Norm activation theory and Protection-Motivation theory. The process of question development included the identification of elements that might affect meat consumption and their assignment to the theories'

components. Hence, the questions were established with an aim at measuring the main variables of these theories in the context of meat consumption. All questions were newly developed for this study. Due to the restricted time frame of a master thesis no pilot study to test the measurement instrument could be conducted. The questions were presented in a randomized order in the questionnaire.

The questions were formulated in English and then translated to Norwegian by two fluently Norwegian speakers; a quality check was held by two additional people. It was then printed in both languages, with a higher amount of prints in Norwegian, as it was assumed that most participants would be fluent speakers of Norwegian. Therefore, participants could choose the language by their own convenience. Printing additional questionnaires for any of these languages was an option, however it was not needed.

Questions were mostly presented as statements for which participants declare their extent of agreement with on a scale of 1-7, where 1 represented a complete disagreement, and 7 represented complete agreement.

The questionnaire also recorded demographic data such as age, gender and whether or not the participant was a student. The gender box was deliberately created as an opened text box with the acknowledgement of a potential wish of participants to declare another gender type than male/female or none at all. As the study refers specifically to Norway, an additional demographic question related to the amount of years a participant has been living in Norway, in case she/he moved to Norway. It was assumed that a minimum of 1 full year resembles a required amount of time for one to acquire local eating behavior. Thus, participants who declared living in Norway for less than a full year were disqualified. Many questions were grouped by measurement scale, for example the extent of agreement with statements. In total, the questionnaire included 57 questions. The full questionnaire (in English) is presented in the appendix.

Data processing

The filled questionnaires were scanned automatically to read in the data. The data was used in a factor analysis and regression analysis. For further analysis missing values were estimated with the maximum likelihood method. Hence, the correct likelihood for the missing value was provided by the marginal distribution of the observed data (Schafer & Graham, 2002).

5. RESULTS

5.1 Factor Analysis

A principal component analysis (PCA) was conducted on the data gathered from 210 participants, using an oblique rotation. The Kaiser-Meyer-Olkin (KMO) measure verified the sampling adequacy for the analysis, KMO= .78 ('good' according to Field, 2009), and all KMO values for individual items, except for one, were above the acceptable limit of .5 (Field, 2009). The exception refers to a vulnerability item which had a value of .49. However, as this value is substantially close to .5, it was decided to relate to it as an acceptable item.

Bartlett's test of sphericity $\chi^2(780)$= 2667.28, p‹0.001, indicated that correlations between items were sufficiently large for a meaningful analysis. An initial analysis was performed to obtain eigenvalues for each component in the data.

The determination of the number of extracted factors was based on several approaches. First, *Kaiser Criterion* was considered. Kaiser's criterion refers to the obtaining of components with eigenvalues higher than 1 (Field, 2009). For the current study, this resulted in the extraction of 13 components. However, this criterion refers to an analysis with less than 30 variables and communalities after extraction greater than 0.7, or a sample size greater than 250 and average communality value higher than 0.6. In the current study, the number of variables is higher than 30, and though the average communality value after extraction for the current analysis is 0.65 (hence, higher than 0.6), the sample size is 210 (hence not > 250). Therefore, another approach was desirable in order to support this factor extraction. Then, a *Scree Plot* was used with the aim of supporting the number of extracted factors. However, the scree plot was slightly ambiguous and showed several inflexion points. While 13 factors was one of its suggestions, its relative unclarity made it inconclusive for a determination of the amount of extracted components, and an additional support was still required. Next, *Monte Carlo* parallel analysis (Hom, 1965) was run and led to the amount of 6 factors to be extracted. Looking at the factor loadings, the suggested factors included a mixture of variables measuring different characters and therefore this option was not considered a useful construct for the study. Finally, a *Standard Error Scree Plot* approach (Zorski & Jurs, 1996) was created using SEscree (Watkins, 2007). This scree plot suggested a total

number of 16 components, however after 13 components the difference between the lines is very small and hence justifies also the extraction of 13 variables (the standard error scree plot can be found in the appendix).

Hence, based on Kaiser Criterion, with the support of two additional methods of the scree plot and the standard error scree plot, 13 factors were extracted for this analysis. In combination, the extracted components explain 65.05% of the variance.

A pattern matrix that features the 13 extracted factors, factor loadings after rotation, the variance in the model accounted for by the factor, and the eigenvalues is presented in the appendix (appendix 2).

Based on this analysis, factors were created accounting for selected items that showed high loading for the factor. For each factor, the mean score and standard deviation was calculated (see table 1). In general, items that cluster on the same components represented a unified dimension, though in some cases minor changes were done to the suggested SPSS components in order to obtain a better comprehensiveness of the data. These changes occurred for the following factors:

- For factor no.3, labeled "PBC", the item "I see many advertisements for meat products in the media" was taken out. This change was done as this item clearly did not fit with the other 4 items loaded for this factor, all measuring PBC. Moreover, the media's influence is presented in another factor (no.7), where high loading was found for a parallel variable ("I see many advertisements for vegetarian products in the media").

- Items loaded on factor 5 were split into two factors no. 5 and 6, labeled "Attitudes" and "Habits". This split was based on a theoretical background with the assumption of attitudes and habits being important actors for determining behavior. Therefore, it was desired to test their influence on behavior separately. Moreover, this split can be supported by the difference in the items' loading: the attitude item loading was 0.45, while the habit items' loadings were between -.74 and -.78. In addition, two items were not included: "My family thinks that meat is an essential part of a diet", as it attributes to social norms and does not fit for measuring the influence of attitudes or habits; "Familiarity with vegetarian dishes" as it does not fit with attitudes and while it might have some affiliation with habits, it can be measured indirectly only. Also, its loading (.43) was substantially lower than those of the other items attributed to the habits factor

(.74 or higher). This split to two factors generated a further change in the correspondence of the original component number in the pattern matrix and the final factors.

- The item"Extent of care for friends' opinion regarding one's change of eating habits" was not included in factor no. 7, "Media". This factor accounted for meaningful loadings of two items only, one of which is this mentioned item which relates to social norms and had a loading value of .41, and the other relates to the media's influence on behavior and its loading was much higher, at .76. As these two items measure very different aspects, it was decided to keep only one for a clear factor. As social norms are presented in factors 2 and 10, and supported by a lower loading, the item was removed from this factor.

- Factor 11 was ignored as it included loadings of two items accounting for different theoretical elements of health beliefs and social norms. This combination was considered incomprehensive for the analysis, and a further justification for ignoring this factor is that these elements were found to be the main focus of other factors (no.2 and the new no.11).

- Lastly, the item "Eating meat is a strong part of Norwegian culture" was not included in factor no.13, "perceived costs". This factor had two meaningful loadings of unrelated variables; one was considerably higher (.82 compared to .42) and accounted for perceived costs and therefore was chosen to represent the factor. However, the item that was taken out is of special interest for this thesis as it accounts for the influence of culture and draws attention to specific Norwegian motivation for behavior. For this reason, though not included in the defined factors, this item was considered further in the analysis.

The adjusted components are the final 13 factors that were used further in the analysis and represent the following dimensions: moral beliefs about environmental impacts, injunctive norms, perceived behavioral control (PBC), general approach towards environmental issues, attitudes, habits, media's impact, self responsibility, health beliefs, descriptive norms, vulnerability, awareness towards environmental impacts, and perceived costs. A reliability test was done for each factor that includes more than one variable, using the measure of Cronbach's α. A threshold of 0.5 was used due to the relatively low number of variables loaded on each factor (1-5 variables), and all factors produced higher Cronbach's α results than this threshold. However, factor no.9 produced a result that is quite close to this threshold (.52), therefore its reliability should be interpreted with caution.

Table 1 presents the final 13 factors. For each factor, it presents the variables included, mean, standard deviation and the values of Cronbach's alpha test.

	Factor name	Variables and loadings	Mean	S.D.	α
1	moral beliefs about environmental impacts	• Animals in the meat industry are very well treated[*] • Compared to other industries, the meat industry is generating large amounts of waste • The meat industry is cruel • Is including ethical considerations in food choices a good idea? • Compared to other industries, the meat industry has a high impact on biodiversity	4.52	1.01	.71
2	Injunctive norms	•Reducing meat consumption would affect my relationship with my family •If I became vegetarian, my social life would be damaged •My friends and family will support me if I choose to change my diet so that it includes less meat[*] •People who are important to me think that I should eat meat	2.49	1.20	.67
3	PBC	•I am confident that if I wanted to, I could reduce meat in my diet •It is difficult for vegetarian people in Norway to eat in restaurants •Becoming a vegetarian would be easier if there were more vegetarian dishes available in restaurants and cafeterias •If more people demand vegetarian food, its availability will rise	4.83	1.07	.62
4	General approach towards environmental issues	•Human behavior has a strong impact on the environment •Importance of environmental issues •I am interested in learning about ways to reduce my environmental impact	5.90	1.04	.67
5	Attitudes	•Would introducing vegetarian dishes be considered as pleasant?	4.89	1.58	.76
6	Habits	•Eating meat is something I do without thinking •Eating meat is something I do automatically •Reducing the amount of meat in my diet will require a lot of effort from me	4.76	1.50	
7	Media's impact	•I see many advertisements for vegetarian products in the media	2.53	1.37	
8	Self responsibility	•My individual choices matter	5.76	1.40	
9	Health beliefs	•Consuming high amounts of meat might cause serious health problems •A vegetarian diet can help reducing the risk for heart attacks	4.50	1.28	.52
10	Descriptive norms	•known limiting meat consumption •known vegetarians	4.19	6.61	.69
11	Vulnerability	•I am less vulnerable than other people my age to get a heart disease	4.00	1.52	
12	Awareness towards environmental impacts	•The meat industry is responsible for deforestation •Meat consumption is one of the main environmental problems •A meat based diet is more environmentally friendly than a vegetarian diet[*]	4.59	1.24	.65
13	Perceived costs	•Is a vegetarian diet more expensive than a meat based diet?	4.19	1.74	

* The item was reversed for the analysis.

Table 1: *The final 13 factors*

5.2 Regression Analysis

Three regression analyses were performed, testing for powerful predictors for three dependent variables. First was behavior (measured by the frequency of meat eating, using an ordinal scale of which 0=never, 1= rarely 2=special occasions, 3= sometimes, 4= one or more times a week, 5=daily); the second variable was intention to reduce meat consumption (measured by an ordinal scale where 0=no intention to change, 1=intention to reduce meat consumption to special occasions, 2=intention to avoid the consumption of specific types of meat, 3=intention to become vegetarian, 4=intention to become vegan); the third variable was the extent of moral beliefs about environmental impacts (combining measurements of the various items loaded for factor 1, as described above). The variables included in the analysis include the 13 factors and an additional item measuring the perception of the behavior in relation to specific culture ("Eating meat is a strong part of Norwegian culture").

The following section describes the characters of each regression and its result. The mean and standard deviation were calculated for this item too and resulted in: mean

1. Dependent variable: Behavior

This analysis was performed to identify the elements that assign powerful influence for one's eating meat, and the predictors that were considered include all 13 extracted factors. Due to the character of the measuring scale of the dependent variable, the technique used was ***ordinal regression***. Furthermore, a link function of Complementary log-log was chosen, which is appropriate to use when higher categories more probable (Norusis, 2012). This fit best to this specific analysis since higher categories were indeed expected for behavior in this case (i.e. more cases were expected to report some- high meat consumption than little- none).

The overall fit of the model had an observed significance level of less than 0.0005. Therefore, the null hypothesis that the model without predictors is as good as the one with predictors could be rejected (Norusis, 2012), indicating that the current model was indeed a better predictor for the data. The -2 Log Likelihood was 463.57 for the intercept only and 119.06 for the final, with a χ^2= 344.50 (p < .001). The strength of the association between the dependent variable and the predictor variables was measured by three pseudo R^2 statistic measures. All of them showed high values as follows: .817 for

Cox and Snell, .909 for Nagelkerke, and .743 for McFadden. Moreover, a test for parallel lines was run in order to find whether the general model results in a sizeable improvement in fit from the null hypothesis model (Norusis, 2012). The significance level was 1.00, providing support for the null hypothesis of parallel lines in the model. Table 2 displays the regression coefficients for each predictor

	Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Moral beliefs about environmental impacts	.04	.14	.07	1	.797	-.23	.31
S. Norms- injunctive	.12	.09	1.84	1	.175	-.06	.30
PBC	.17	.11	2.22	1	.136	-.05	.38
General approach towards environmental issues	-.19	.12	2.55	1	.110	-.43	.04
Attitudes	-.10	.10	1.02	1	.312	-.29	.09
Habits	**.63**	**.10**	**43.69**	**1**	**.000**	.44	.82
Media Impact	.02	.08	.08	1	.775	-.13	.17
Self Responsibility	.00	.08	.00	1	.995	-.16	.16
Health Beliefs	**-.22**	**.09**	**6.09**	**1**	**.014**	-.40	-.05
S. Norms- Descriptive	.00	.02	.00	1	.961	-.03	.03
Vulnerability	.00	.07	.00	1	.978	-.13	.14
Awareness towards environmental impacts	.03	.10	.11	1	.739	-.17	.23
Perceived Costs	-.01	.06	.02	1	.892	-.12	.11
Eating meat is a strong part of Norwegian culture	-.03	.07	.16	1	.687	-.17	.11
Intention to become vegan	.63	.32	3.74	1	.053	-.01	1.26
Intention to become vegetarian	.57	.35	2.59	1	.108	-.12	1.26
Intention to avoid specific types of meat	**-.98**	**.44**	**4.99**	**1**	**.026**	-1.85	-.12
Intention to limit meat consumption to special occasions	**-2.79**	**.64**	**18.89**	**1**	**.000**	-4.05	-1.53
No intention to reduce meat consumption	0[a]	.	.	0	.	.	.

Link function: Complementary Log-log.

Table 2: *Predictors' contribution for the dependent variable "behavior"*

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Three variables were found to have a strong correlation with behavior: habits, which had a positive relation; health beliefs, which had a negative relation; and intention to reduce meat consumption, expressed by two items, which also had a negative relation with behavior. Hence, strong habits of meat consumption, and/or weak health beliefs regarding the effect of meat eating on health state would generate a higher frequency of meat consumption; a stronger intention to reduce meat consumption would result in lower meat eating frequency.

2. Dependant variable: Intention

This analysis was performed to identify the elements that strongly attribute to one's intention to reduce his/her meat consumption. The predictor variables included the 13 extracted factors and an additional variable that measures cultural influence. An *ordinal regression* was performed, with a Negative log- log link function. This link function is appropriate to use when lower categories are more probable (Norusis, 2012), which was the assumed case here (i.e. more cases were to report higher meat consumption than little/ none).

Also for this regression analysis, the overall fit of the model had an observed significance level of less than 0.0005, and the null hypothesis that the model without predictors is as good as the one with predictors was rejected. The -2 Log Likelihood was 347.34 for the intercept only and 366.23 for the final, with a $\chi^2 = 131.12$ ($p < .001$). Pseudo R2 values were high: .474 for Cox and Snell; .520 for Nagelkerke; .264 for McFadden, and the test for parallel lines was positive, with a significance of .99. Table 3 displays the regression coefficients for each predictor.

	Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Moral beliefs about environmental impacts	.26	.16	2.45	1	.117	-.07	.58
S. Norms- injunctive	.10	.10	1.02	1	.313	-.10	.31
PBC	.11	.13	.71	1	.398	-.15	.36
General approach towards environmental issues	**.39**	**.16**	**5.64**	**1**	**.018**	**.07**	**.70**
Attitudes	**.36**	**.12**	**9.69**	**1**	**.002**	**.13**	**.58**
Habits	-.16	.09	3.18	1	.075	-.34	.02
Media Impact	.09	.09	.95	1	.330	-.09	.27
Self Responsibility	-.13	.09	2.30	1	.129	-.31	.04
Health Beliefs	**.27**	**.10**	**6.68**	**1**	**.010**	**.06**	**.47**
S. Norms- Descriptive	.03	.02	3.53	1	.060	-.00	.06
Vulnerability	.04	.08	.28	1	.596	-.11	.19
Awareness towards environmental impacts	.19	.12	2.58	1	.109	-.04	.410
Perceived Costs	-.00	.06	.00	1	.980	-.13	.13
Eating meat is a strong part of Norwegian culture	-.10	.08	1.90	1	.168	-.25	.04

Link function: Negative Log-log.

Table 3: *Predictors' contribution for the dependent variable "intention"*

Three predictors were found to have a strong correlation with intention: General approach towards environmental issues, attitudes, and health beliefs. All of these predictors account for positive relations with the dependent variable. Hence, the more pro-environmental is one's general approach towards environmental issues, and/or the more in-favor are one's attitudes towards environmental issues, and/or the stronger one's health beliefs regarding the effect of meat consumption on health state- the greater one's intention to reduce meat consumption would be.

3. Dependent variable: Moral beliefs about environmental impacts

In this analysis, predictors that establish moral beliefs about environmental impacts were to be identified. The interval scale of this variable allowed a multiple **linear regression** and this was performed.

Overall, the model accounted for 44.8% of the variance in moral beliefs about environmental impacts and itis a significant fit of the data ($F(13, 196) = 12.22, p < .001$). Four predictors were found to determine moral beliefs about environmental impacts:

1. Awareness towards environmental impacts significantly predicted moral beliefs about environmental impacts, and had the highest predicting power. The beta value indicates a positive relation, indicating that as the awareness level increases, so does the extent of moral beliefs about environmental impacts.

2. Attitudes towards environmental issues significantly predicted moral beliefs about environmental impacts, and its beta value indicated a positive relation. Hence, the stronger is the attitude in favor of environmental issues, the greater is the extent of moral beliefs about environmental impacts.

3. General environmental beliefs significantly predicted moral beliefs about environmental impacts, and its beta value indicated a positive relation as well. Hence, the stronger the beliefs are, the greater is the extent of moral beliefs about environmental impacts.

4. Media impact significantly predicted moral beliefs about environmental impacts, and its beta value indicated a negative relation. Hence, a higher impact of the media generates a lower extent of moral beliefs about environmental impacts in ones decision-making process.

Table 4 reports a summary of the regression results. The predictors are organized by descending ordered according to their importance for the model (determined both by B values and a t-test).

	B	Std. Error	Beta	t	Sig.
(Constant)	2.155	.594		3.628	.000
S. Norms- Injunctive	-.062	.047	-.074	-1.326	.186
PBC	.034	.060	.036	.574	.567
General approach towards environmental issues	**.120**	**.059**	**.124**	**2.047**	**.042**
Attitudes	**.139**	**.048**	**.219**	**2.903**	**.004**
Habits	-.061	.044	-.091	-1.401	.163
Media Impact	**-.079**	**.041**	**-.108**	**-1.954**	**.052**
Self Responsibility	.044	.040	.061	1.114	.267
Health Beliefs	.060	.046	.076	1.306	.193
S. Norms- Descriptive	.016	.009	.104	1.719	.087
Vulnerability	-.033	.037	-.050	-.917	.360
Awareness towards environmental impacts	**.224**	**.051**	**.275**	**4.404**	**.000**
Perceived Costs	.006	.032	.010	.183	.855
Eating meat is a strong part of Norwegian culture	-.010	.037	-.015	-.264	.792

Note: R^2=.45 ($p < .001$).

Table 4: Result summary of a regression analysis for the dependent variable 'moral beliefs about environmental impacts'.

Several measures were taken to check for the validity of the model:

Multicollinearity: None of the correlation coefficients was substantially high, indicating for no multicollinearity between the variables; In addition, for all the variables included in the analysis, VIF values are below 10 (as well as the tolerance values are all well above 0.2) indicating that there is no multicollinearity in the data.

The adjusted R2 was .41.

Normality of errors: The histogram reveals a normal distribution, verified by the P-P plot.

Error independence: Durbin-Watson statistic produced a result of 1.919, which falls within Field's (2009) recommended boundaries of 1–3 and also very close to the value of 2 which indicates that the residuals are uncorrelated (Field, 2009).

Lastly, a scatterplot of ZPRED against ZRESID was produced and showed a random and even distribution of the residuals, indicating that the assumption of Linearity and Homeostacity were met.

Overall, the model was considered fairly reliable.

6. Discussion

6.1 The results

The study of this Masters' thesis was aiming at finding the barriers and facilitators for a reduction of meat consumption in Norway. It formed an integrated model based on aspects from three theories utilized, chosen for the idea that meat consumption is a social, health, and environmental issue: the theory of planned behaviour, norm activation model and protection motivation theory. A questionnaire was formed based on these theoretical constructs, accounting for a content of moral aspects, health aspects and environmental impacts of meat consumption.

The results show three significant predictors of meat consumption: first, the behaviour of meat consumption has a positive relation to meat eating habits, and a negative relation to health beliefs and the intention to reduce meat consumption. Second, the intention to reduce meat consumption is related to one's general approach towards environmental issues, attitudes, and health beliefs in positive relations. Third, moral beliefs are related to one's awareness towards environmental impacts, attitude towards environmental issues and general environmental beliefs in positive relations, and it is negatively related to the impact of media. Figure 11 presents the results.
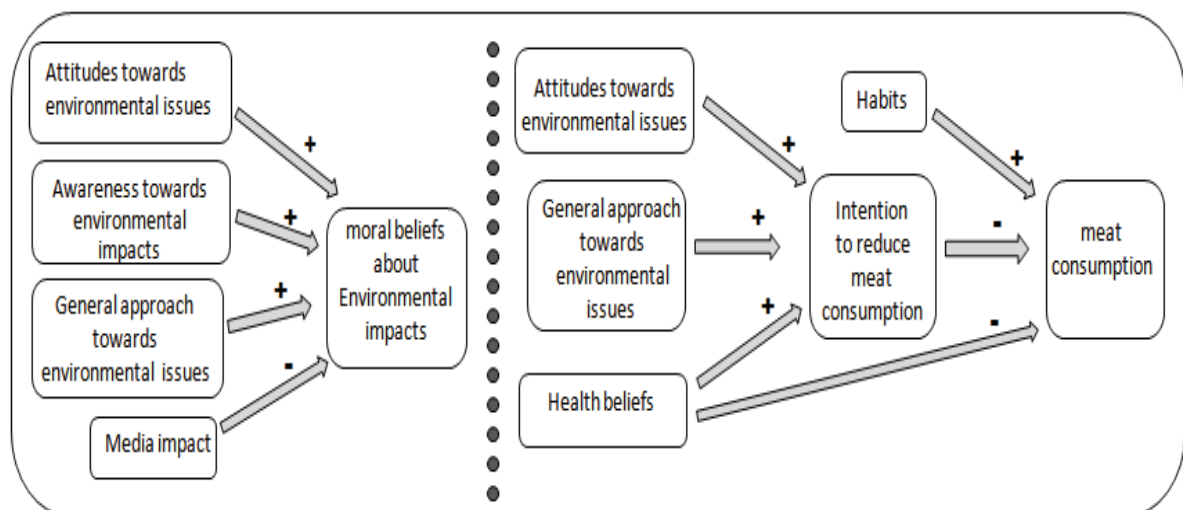
Figure 11: Results

These relations imply that stronger beliefs regarding the negative effect of meat consumption on one's health state would generate a stronger intention to reduce meat consumption; higher pro-environmental approach towards environmental issues, and

more in-favor attitudes towards environmental issues also lead to a stronger intention to reduce meat consumption; lower consumption habits of meat and higher health beliefs directly influence the behaviour of meat consumption; higher level of awareness lead to stronger moral beliefs about environmental impacts; the more in-favor are attitude of environmental issues and the stronger general environmental beliefs are, the stronger are moral beliefs about environmental impacts; higher perception of pro-meat media leads to weaker moral beliefs about environmental impacts.

Relating to the hypothesis, the results support some of them, but not all.
The following findings support the hypothesis:

• A direct effect of the intention to reduce meat consumption on the behaviour, and a direct effect of attitudes on intention. These results support main assumptions of the theory of planned behaviour, where the direct relation between intention and behaviour, and the direct effect of attitudes on intention are fundamental elements of its structure.

• A direct effect of habits on behaviour. This finding supports the argument for the importance of habits as determinates of an everyday behavior and their relevance for the assumed model of the study.

• An effect of health beliefs on the behavior. This supports the assumptions of the protection motivation theory and the inclusion of health aspects in the model; however, while the hypothesis assumed this effect to be mediated through intentions, the results show both a direct and indirect effects between health beliefs and behaviour.

• A direct effect of awareness towards environmental impacts on moral beliefs about meat consumption. This relation supports an assumption of the norm activation model, where the awareness of consequences (expressed by the awareness towards environmental impacts in the current study) has a direct, activating effect on personal norms (approximated by moral beliefs).

The following findings differ from the hypotheses:

• Moral aspects (or 'personal norms') did not show significant relations with the behaviour of meat consumption or the intention to reduce it. This is surprising as moral aspect were expected to influence the behaviour negatively, or to influence intentions to reduce positively. The expectation of such significant relations is based on studies that found personal norms an important predictor of pro-environmental behaviour (for

example, Kalof et al., 1999). Stern et al. (1993) argue that it is not only self-centered and environmental value orientations that initiate an environmental significant behaviour, but also a social-altruistic value orientation that concerns the welfare of other people. Thørgersen (1996) argued that environmentally relevant behaviors should be classified as belong to the domain of moral behaviours, rather than economic behaviors. Therefore, instead of balancing personal costs and benefits, people evaluate environmentally relevant behaviors in terms of right and wrong.

There are several possible explanations for the deviation of the results from the hypothesis. First, it might have to do with a measurement problem; hence, it is possible that the questions aiming to measure personal norms were perceived differently by the participants. Second, moral aspects might have been already included within other factors such as general approach towards environmental issues. For example, this latter factor included an item that assigns responsibility to the individual, though not in a direct manner ('Human behavior has a strong impact on the environment'). This explanation can be supported by Harland et al. (2007), who argue that personal norms are sometimes overlapping with concepts of TPB. Moreover, Klöckner (2011) argues that attitudes can reflect values in a specific context. If moral aspects are reflected through attitudes or through general approach towards environmental issued in the current study, then they do account for a relation with intention due to the direct effect that was found for attitudes on intention. Moreover, moral beliefs were found to be related to both attitudes and the general approach towards environmental issues, however, since the study was correlational, the direction of the relations are not defined. Therefore, it is possible that moral beliefs influence behaviour through the mediation of attitudes or general approach towards environmental issues, and hence also influence the behaviour through the additional mediation of intention. A support for such possible assumption can be found in a study by Honkanen, Verplanken and Olsen (2006), who found a significant influence of moral aspects on intention through the mediation of attitudes. This study is of special interest due to its focus on food choices, its strong association between environmental and animal rights issues and attitudes, and the fact that the study took place in Norway. They examined the role of ethical motives in consumers' choice of organic food. Specifically, they investigated the relations between ethical motives, attitude and

intention to consume organic food with a sample of 1283 Norwegians. Their results showed that environmental and animal rights issues had a strong influence on attitudes towards organic food, a significant relation between attitude and intention, and a significant relation between the three ethical value dimensions of ecological, political and religious motives, and attitudes. Amongst these motives, ecological motives (accounted for environmental and animal welfare concerns) had the strongest impact on attitudes. This indicated that the more concerned people are with environmental and animal rights issues, the more in favor their attitudes are towards organic food. The authors note that other potential factors might influence the attitude towards consumption of organic food, such as health concerns, price and availability.

Third, it is also possible that moral aspects in general, or the specific moral aspects measured in the current study, were not an important factor for the specific population in the sample. Lastly, the results might reflect a non-representative sample.

• No significant relation was found between social norms or cultural aspects and intention or behaviour. The explanations given above can also be applied to reason this result. Hence, this too might be a result of measurement problems, its expression through another variable or its irrelevance for the current sample. These results are surprising as both descriptive norms and injunctive norms were expected to influence the intention or behaviour. For example, Steptoe et al. (1995) argue that food consumption is a matter of social interaction. Moreover, Kalof et al. (1999) argue that one's choice of a vegetarian diet involves social psychological factors of two types. One include components such as attitudes, beliefs, norms and values that affect the individual choice of particular food types; the other is the discourse of vegetarianism as a social movement, where vegetarianism is associated with personal health benefits, pro- animal welfare, a way to relieve world hunger and reduce damage to the environment.

Not only did cultural items from the questionnaire not appear to be a factor in the factor analysis, but also no significant relations were found when this aspect was added as a single item to the regression analysis. The expectation of the influence of culture was based on its affiliation with social norms and the association of these two components with food consumption. Steptoe et al. (1995) argue that cultural factors are dominant in food choices as they lead to differences in consumption habits and traditions of food

preparation, and sometimes involve restrictions on particular food items. Nestle (1998) argues that culture is the extensive foundation that establishes all food choices as people rely on the norms of their specific cultures, subcultures, and ethnic groups to determine what they consider as acceptable and preferable foods. Itmight be that the lack of the significant relation in my study is due to imprecise capture of specific Norwegian cultural items in the questionnaire. Another possible explanation is that being an integrated part of the culture, participants had problems to observe its influence on themselves.

• No significant relation was found between perceived behaviour control and behaviour or intention. In particular, accessibility, availability, and price were assumed to be found as barriers to form the intention or execute the behaviour in this study. This expectation was initially based on self experience as these factors were constantly brought up during informal conversations with people in Trondheim regarding their thoughts of vegetarian and vegan diets. Furthermore, this expectation is supported by results shown in similar studies. For example, in the case of organic and fair-trade foods, which are also affiliated with ethical, social and environmental aspects, Shanahan, Carlsson-Kanyama, Offei-Ansah, Ekström, and Potapova (2003) found high prices, limited availability and uneven quality as main external barriers for consumption. A possible explanation to the lack of significant contribution of PBC in the current study is that the items designed to measure PBC failed to represent elements that apply to the specific situation.

Based on these findings (and assuming that moral beliefs do reflect through attitudes), the barriers to individuals' reduction of meat consumption in Norway are the influence of the media and meat eating habits. The facilitators of such reduction are beliefs regarding negative impact of meat consumption on health, an in-favor attitude towards environmental impacts and a positive general approach towards environmental issues, moral beliefs regarding environmental impacts and awareness towards environmental impacts.

6.2 Limitations

There are several limitations for the study. The study aimed to examine the specific behaviour of Norwegians. However, the data collection took place in Trondheim only; whilethis is one of the biggest cities in Norway, it is not a representative sample for Norwegians as population. Second, though the questionnaire was filled anonymously,

participants were approached in person. Hence, while trying to keep the sample as random as possible, it is likely to assume that some amount of self-judgment was included when choosing the individuals to ask for participating in the study. Moreover, the data collection took place during winter 2011, and it is likely that Trondheim's winter conditions had some effect on determining the available sample. This is because it led to a sample that includesonly people who were outside their homes, and in defined indoor facilities. Moreover, participants influenced the sample through their self selection of the topic as interesting or not. Therefore, the sample might have been affected by factors such as individuals' comfort of talking to an approaching stranger (i.e. myself), health condition (as participating required being active outside one's home) and socializing preferences. These reasons should be considered as possible influences on the randomness of the participants. For these reasons, the sample can be identified as not representative and hence, it should not be used for generalizing.

The possibility of biases should be also taken into account regarding the reliability of the data due to the use of self- reported methods. For example, biases due to people's inadequacy of estimating their own vulnerability (Breakwell, 2007); or biases due to social desirability, consistency motives and the person's mood at the particular time of participating in the study (Podsakoff, MacKenzif, Lee, &Podsakoff, 2003).

Finally, another limitation is regarding the formulation of questionnaire items, as during data collection several problems emerged regarding items in the questionnaire. Such problems might have led to misunderstanding of the question and subsequently, an inaccurate answer, or that some questions did not measure what they were meant to.

A problem of potential double counting occurred in three cases. First, question 5 includethe potential of double counting. This question measured meat eating frequency ('How often do you eat meat?') and three of its answering options were 'never', 'I am a vegetarian' and ' I am a vegan', for the purpose of finding out the amount of vegetarians and vegans in the sample without an additional question. However, a vegetarian could then choose both options of 'vegetarian' and 'never', a vegan could choose both 'vegan' and 'never', and those who chose 'never' might be either vegetarians or vegans. A second case is questions 10 and 11: 'how many vegetarians do you know, and 'how many people do you know who are limiting their meat consumption', respectively. This is because

some participants might have included people who do small amounts of meat as vegetarians, or include vegetarians as people who are limiting their meat consumption. For better clarity, question 10 could have been phrased at 'how many people do you know who do not consume any meat?' and question 11 should have emphasized that it account for additional people to the vegetarians who were counted before. The third case is question 23 which examined participants' intention to limit meat consumption. It included four behaviours and participants were asked if in the near future they may consider stop eating meat products completely, stop eating animal products completely, stop eating selected animal products completely or limit their meat consumption to special occasions. Answering options included 'yes', 'no' and 'I am already doing that'. Vegetarians and vegans should have had problems answering the latter two behaviours as they do not consume any meat at any time. Moreover, while the question aimed at measuring participants' intention, it also measured behavior, through the option of 'I am already doing that'.

Some questions that referred to meat consumption included a skipping option for participants who do not consume meat at all. This generated several cases of missing values (that were handled with estimated values with the maximum likelihood method. See chapter 4).

Measurement problem rose in some questions. A fundamental reason for these is the fact that the questionnaire was not based on previously tested questions. Rather, questions were formed from scratch, along with my first experience in the psychology discipline and the introduction to psychological tools that affect pro-environmental behaviour. Though the items did not follow existing questions and the formation accounted for some degree of creativity and improvisation, they were formed with much thought and care. Using existing, previously-tested questions could have resulted in higher measurement accuracy, as well as pre-testing of the questions that were created for this study would have. However, the Masters' thesis does not account for a pilot test of the questions, and therefore, some problems became apparent only during or after data collection.

6.3 A system perspective and related interventions

This master's thesis focuses on the individuals' behavior. However, it is important to put the individual consumers in context as they only represent one part of a complex

system that is affecting and affected by the production and consumption of meat products. Figure 12 presents a scheme of the system for the production and consumption of meat and its main actors, and summarizes the connections between them as presented in this paper.
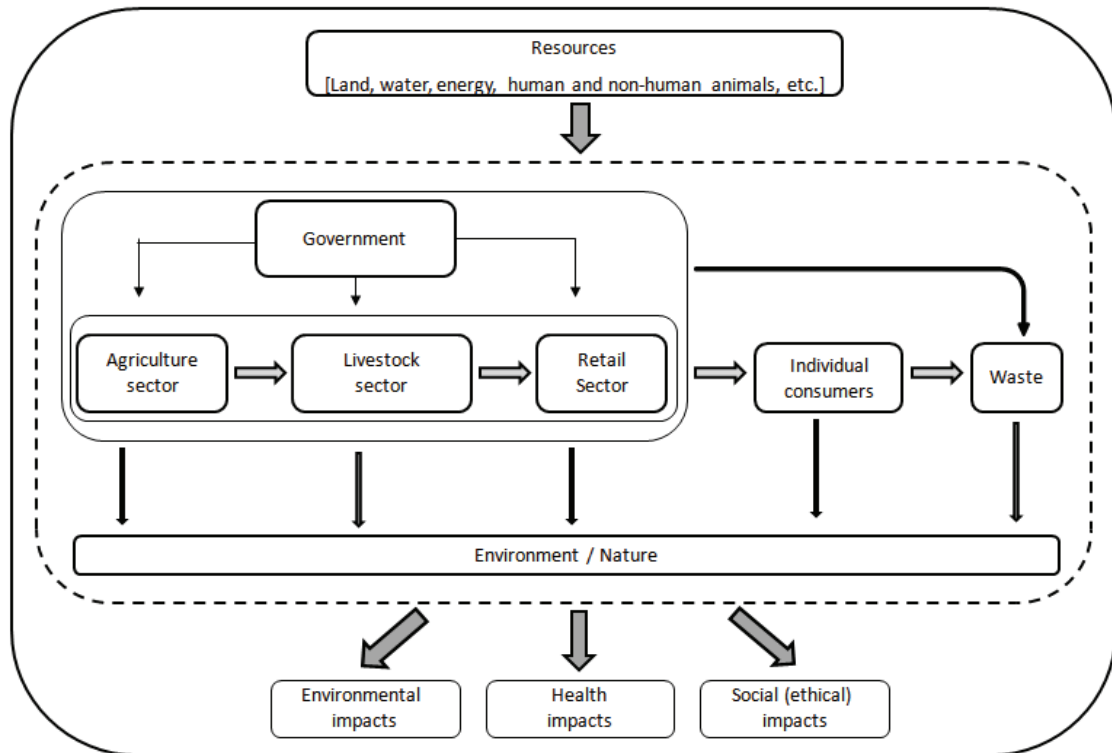

Figure 12: *A system of meat production and consumption*

Hertwich (2005) argues that sustainable consumption patterns can be defined as "patterns of consumption that satisfy basic needs, offer humans the freedom to develop their potential, and are replicable across the whole globe without compromising the Earth's carrying capacity" (p. 4673-4674). As described in chapter 3.3, extensive resource depletion attributed to meat consumption makes this behavior to not fit into this definition. Instead, meat consumption can be considered an unsustainable behavior. However, a shift in diet towards plant- based foods can significantly lower environmental impacts as the environmental burden of plant- foods is substantially lower than livestock products (UNEP, 2010). Therefore, interventions that initiate such a shift have a very high potential to result in a meaningful positive environmental change. Considering the system as a whole is especially important for intervention planning, as a change in one component in this system might affect the others. It is not only the consumers who affect

the industry by their demands, but the industry affects consumer's preferences as well. Gossard and York (2003) emphasize that meat production and consumption cannot be readily explained by biological necessity since not only meat is unnecessary for a healthy diet, but it is also a leading cause various health problems; therefore, they argue that other factors, social factors, play a major role in determining individual dietary patterns. These include political structures, for example the influence of governmental subsidies, industrial pressure groups, and cultural manipulation such as advertisements. Hence, the authors say that the consumption might be generated by the production sectors that hold control over the values and beliefs of a culture.

In order to effectively change the current levels of production, consumption and the impacts of the meat industry, interventions should target each of the system's components. In some cases, the same type of intervention can be applied to different actors in this system, such as providing information or increasing responsibility ascription to both consumers and industrial sectors. However, this is not to underestimate the power of the individual to generate a significant change, as the potential of joint individuals to make a significant difference is a unique quality of the behavior in question. While many environmental problems seem to be out of one's hand to control, the impacts of meat consumption can be addressed directly by individuals who can reduce (or eliminate) those impacts upon their own decision and action, simply by resetting their choices of food purchase (Jungbluth, Tietje, &Scholz, 2000). Moreover, there are various ways for individuals to utilize such potential of a change, whether it is a basic personal decision of a shift in one's diet that is executed in private, or engaging in advocating actions. Such actions might be also focused on individual consumers, or on institutional authorities, for example by creating a strong lobby or a pressure group on governments.

Nordgren (in press) describes three approaches in the aims of interventions for reducing meat consumption: differentiated reduction (i.e. ''less chicken''), non-differentiated reduction (''less meat''), and elimination (''no meat''). It should be noted that while the first two approaches include a reduction in meat consumption and therefore they may lead to some reduction of its impacts, they do not fully answer the problems presented here. For example, they do not answer the ethical aspects of using and killing animals for non-survival reasons. Moreover, they do not eliminate the wasteful nature of

the industry that uses more resources than a meat-free industry and hence not only generating avoidable global environmental problems, but also involved in environmental and social injustice. In other words, some of the ethical and environmental problems that are assigned to meat consumption are fundamental elements of the meat industry, and though reduced consumption would decrease their extent, it would not give a definite solution to the problems. In order to answer these aspects, a more profound change is required, that abolishes, not only reduces, meat production and consumption. It is possible, however that an intervention designed to reduce meat consumption will lead further to a complete avoidance of meat, for example due to very strong moral beliefs that might rise as a result of the intervention, or successful coping appraisals and encouraged PBC that might make the consumption of alternative food products very appealing. Such abolishment would make a substantive effect on the impacts attributed to meat consumption, including environmental impacts. This argument is supported by Nordgren (in press) who argues that the most straightforward way to reduce GHG from livestock is to reduce the numbers of animals farmed significantly and absolutely. Furthermore, Goodland and Anhang (2009) argue that an effective strategy for climate change mitigation must involve replacing livestock products with better alternatives, and not only offering substitutions of one meat product with another.

Some scholars argue that it is the action on the individual level that has a high impact potential for the topic of food production and consumption. Reijnders and Soret (2003) argue that encouraging individuals to eat more efficiently by eating lower on the food chain, consuming less meat and more plant-based foods is an effective measure to increase sustainability and reduce environmental costs from food production systems. Xue and Landis (2010) point out that changes food choices on the individual level may lead to a change on various levels; not only it offers consumers a unique opportunity to lower their personal ecological footprints, but it may also offer national improvements in water quality.

Other scholars argue that interventions on an institutional level are more effective for managing environmental problems. For example, Gossard and York (2003) argue that the structural power of the meat industry is expected to be a major determinant for the extent of meat consumption. This is because powerful corporate interests have a major

impact on consumerism (Crono, 1991; Fine & Leopold, 1993). Brower and Leon (1999) argue that in many cases, in order to reach an effective pro-environmental product choices, products' availability should be changed at the corporate, institutional, or government level rather than rely on individuals' choices. They use the example of the Montreal Protocol on Substances (1987), where agreements were reached regarding the reduction of the use of CFCs and Halons in order to protect the depleting Ozone layer. Hence, the availability of products was determined by governments who bear the responsibility for overcoming obstacles to suggested solutions for the healing of the ozone layer, while individual consumers are deprived of the choice for products that damage it.

Intervention tools for individual and institutional levels

While sometimes the same intervention strategy can relate to both individual and institutional level, different tools are used for each of these groups.

In order to initiate a change on the individual level, the main intervention tools usually focus on distribution of information, awareness rising, and empowering individuals to have the ability to make informed choices. For example, these might include *public education campaigns and programs*. Goodland (1997) argues that several applications of such programs can be effective: introduction of a pro-environmental diet change through school feeding programs, programs that focus on improving maternal and child nutrition, and holding campaigns to proclaim the major and inevitable health risks associated with eating high on the food chain. Carlsson-Kanyama and González (2009) argue that better synergy between environmental and health education can lead to a diet change within a relatively short timeframe. The media can be also used to increase individual's awareness, whether it is by newspaper articles, TV articles, advertisements, online articles and so on. Nestle (1998) argues that the media has a persuasive quality and for many people it is a principal source of information about food and nutrition. The strong persuasive power of advertisements can be exhibit through its influence on people to purchase products that are not on their best interest (health, moral and environmental-wise) such as cigarettes, sweets, products made of toxic materials, and so on, including meat products.

Shanahan et al. (2003) argue that it is especially important to create awareness in high-income countries because they hold for opportunities to change towards a more sustainable diet. However, education and awareness rising should not be limited to developed countries, where meat consumption is already high. Goodland and Anhang (2009) emphasize the importance of education spread as an effective tool to prevent undesired future scenarios. They point out that in developing countries per-capita meat and dairy consumption is lower than in developed countries; however, consumers in developing countries often perceive meat and dairy products as part of a better diet and a higher life style, and have not been informed about their adverse impacts. Therefore, educating people in developing countries about these impacts is important, as it might prevent a growth in the consumption of livestock products.

Interventions that focus on the individuals might affect the institutional level through shifts in product demands and creation of pressure groups and lobbyism activity by engaged individuals.

Referring to the model suggested in this paper, such interventions may influence the behaviour through the components of awareness, attitudes, health beliefs and general approach towards environmental impacts.

Intervention tools for institutional changes include shifts on a macro level. The following are common tools for interventions on the industrial and political fields.

• *Command- and- control regulations or market based approach.* Such interventions include taxes, regulations, subsidizes and policy changes. Goodland (1997) suggests the application of *taxing mechanism* to food products. In this mechanism, a high tax will apply to inefficient foods (such as cattle and pork), and no tax or low tax will be applied to more efficient foods. He argues that such a system will ensure that people who eat high up the food chain also pay the full environmental and social costs of their dietary choices. McMichael et al. (2007) suggest the use of *carbon-pricing* based on GHG proxies assigned to meat production, such as livestock feeds. Furthermore, they argue that a designed policy should give special attention to the health risks attributed to the rapid worldwide growth of meat consumption, generated both from increasing climate change and by directly contributing to specific diseases. Wirsenius, Hedenus, and Mohlin (2010) assessed the emission mitigation potential of GHG taxes on animal food products in the

EU. They found that a tax scheme of differentiated consumption taxes on animal products equivalent to 60 Euros per ton of CO2-e is estimated to lower emissions from food production by approximately 32 million tons of CO2-e. Since such scheme might also affect meat production in regions that are exporting to the EU, the total reduction of GHG attributed to the tax scheme is likely to be even higher. Moreover, Goodland (1997) suggests a *removal of subsidies* for livestock. McMichael et al. (2007) adds that removing state subsidies for animal feed would not only help reduce meat consumption through increased retail prices, but it would also help to redirect grain harvests to local low-income countries. However, it is not just subsides that can substantially affect an industrial sector, but also the extent to which it is supported by through advertisement and governmental campaigns. For example, regarding the meat industry and the case of Norway, governmental budget assigned to promote consumption of meat products included about 66.2 million NOK, while only 9 million NOK were assigned to promote consumption of fruits and vegetables, and 2.6 million NOK were assigned to promote grain consumption (Statens Landbruksforvaltning, 2012). Such budget distribution clearly favors the promotion of meat products. A change towards a higher promotion of fruits and vegetable consumption and a lower promotion for meat consumption can initiate a change on both the industrial level of food sectors and individual level through the influence of advertisements.

Nordgren (in press) supports the use of command and control regulation and market-based approaches for addressing the problems of meat production and consumption such as a ban on meat imports, climate considerations of food in public procurement, the use of emissions trade (from production) and meat taxes on production or consumption. He argues that while voluntary measures are good in theory, they are not sufficient to reach substantial results in climate change mitigation, while regulatory mechanism might be.

• *Business incentives*. Goodland and Anhang (2009) argue that the change in food choices should be considered not only as a public policy or an ethical case, but also as a business case. They argue that companies in the food industry have several incentives to respond to the risks attributed to the livestock industry and adopt a shift to plant-based food production as a business opportunity. Such incentives include a self interest of an individual company to reduce climate change due to its effect on the company for

example by degrading food industry's markets, company's infrastructures and its ability to operate due to disruptive climate events. Moreover, they argue that livestock products would be especially affected by the expected rise of oil demand and price, as crops will be explicitly used for bio-fuel production and therefore will be diverted from livestock. They argue that according to both livestock and financial sectors' predictions, the oil crisis could lead to a collapse of the livestock sector within a few years; therefore, replacing the livestock products with better alternatives as soon as possible will give a company an advantage in a future competition. They authors argue that a food company is able to produce and market alternatives to meat that are analog to livestock products and that account for various advantages over them. For example, the production of products that are plant- based (for example, from soy) that while they taste similar to meat, they are easier to cook, less expensive, and healthier. They argue that meat and dairy analog projects hold for benefits on several dimensions. For the environment, not only they will slow climate change, but they will also help mitigating the global food crisis because it takes a much less crops to produce any given amount of calories of analogs than using livestock. Furthermore, they will ease the global water crisis by saving huge amounts of water that is necessary for livestock production only. On the dimension of health aspects, they argue that such shift will lead to better health state and nutritional outcomes for consumers. On the social dimension, the authors argue that analog projects would be more labor intensive than livestock projects and increase jobs availability, including skilled jobs, and workers of livestock production could be easily guided for analog production. Moreover, such projects would also prevent harmful labor practices that are currently found in the livestock sector, such as slavery. Lastly, they argue that leaders in the food industry, who should welcome the ideas. While the business risks of these projects is similar to most other food production projects, this risk is reduced by the already- existing necessary infrastructure (for example grain production).

Such intervention would affect individual consumers through external PBC in the form of higher product prices for animal-based products and a higher availability of plant-based foods.

Intervention strategies

Intervention strategies may differ by choice of focus, not only between individual and institutional levels, but also the choice of the most important aspect to relate to. This can be illustrated with the following examples of two intervention orientations:

> • *Example 1: Interventions that focus on habit change*

Verplanken and Woods (2006) propose two approaches for habit change interventions: First is a "downstream" interventions aim to reduce existing negative outcomes and are usually targeted directly at the individual consumers. These include education, counseling, informational campaigns and self-help programs that aim at evaluating cost and benefits of the old behavior compared to the new one and increase self-efficacy to perform the behavior. They argue that consumers' everyday lifestyle habits might limit the effectiveness of such interventions; therefore, they are most successful when combined with environmental changes that disrupt existing habits. The second approach is an "upstream" intervention. These are designed to prevent undesired outcomes by providing a contexts and societal structures that promote a desired behavior and sustain it. Such interventions usually focus on the larger structural conditions in which the behaviors are embedded, and include large-scale, macro level policy changes. Such interventions use the institutional tools described above of Command- and- control regulations and market based approach. However, sometimes an intervention can combine these approaches: begin at the downstream level approaching individual consumers, and later expand to approach policy makers for a broader, long-term upstream intervention.

An ongoing project called "Meatless Monday" is an interesting example for such combined intervention. This is a program aiming at raising awareness towards healthy, environmentally- friendly meals, and help people to reduce their meat consumption by providing resources such as online information and recipes (www.meatlessmonday.com). Since its establishment in 2003 in the U.S., the project spread globally and is currently active in 23 countries, including Norway (www.kjottfrimandag.no). Though it is initially based at raising awareness of individuals, this project requires an institutional support, of a school, community, working place etc.

Hence, this initiative appeals to both individuals and institutions, and the emphasis on making a change in a social context. Though the aim is raising individual's awareness, the campaign specifically encourages people to spread the message within their community, work place, school, etc. Another quality of this project which makes it of special interest is it accounts for different extents of individuals' activism levels: whether it is a self-change, setting an example or leading a program in an institute, resources are available in the forms of recipes, articles, tips, starter kits, posters and so on. These allow much room for diverse applications. Indeed, the campaign has been taking different shapes in different places. For example, the project includes restaurants featuring vegetarian and vegan dishes every Monday, weekly Monday recipes articles in print and online newspapers and meat-free dishes servings at school cafeterias (www.meatlessmonday.com). Moreover, a great strength of this campaign is its application on institutions as this allows approaching substantial amounts of individuals at once, and its on-going, weekly nature. In addition to the efficiency of providing information to many individuals in a short time, such repetitive communication carries a potential of keeping the topic a live discussion beyond the particular day a week, as well as the potential of generating a habit. Lastly, such project can be of much help in the case of places where availability, accessibility and familiarity are relatively low. This might be the case in Norway, as in 2002 it was estimated that there are only 4% vegetarians in the Norwegian population (SIFO, 2002). Not only it provides new information to individuals, but it will also show its practical side through a suggested behavior. It should be noted that this project calls for a relatively moderate change of a single day a week only. However, I believe it has a great potential for a positive spillover that would carry the behavior further, from a once-a-week routine up to a change of lifestyle. This is because of the combination of the use of information, presentation of practice, induction of habitual qualities, its nature of empowering individuals with available resources and its occurrence in a social context.

Hence, relating to the suggested model of the study, such interventions would affect consumers through several model components: it would increase PBC through the increase of availability of and familiarity with plant-based food; a food program held by an institute will affect social norms as it involves a social interaction that might increase

both descriptive and injunctive norms; information and awareness raising would affect personal norms AC and AR, and it might enhance or strengthen both beliefs regarding environmental issues that might lead to a pro-environmental attitude, or health beliefs that might lead to a protection motivation; and a repetition of the behavior would induce habits.

• *Example 2: Interventions that focus on moral aspects*

Harland et al. (1999) argue for focusing on one's feelings of personal obligation as an effective way to encourage environmentally conscious behavior. They argue that designing communicative interventions that appeal to personal norms is difficult as it involves both the stimuli of personal norms which come from one's inner- self, and communication of these norms which is derived from an external source. Therefore, a communicated message aiming at generating personally obliged feeling for pro-environmental behavior might be perceived as a communicating of a social norm, where people are telling others how they should feel and act. Nevertheless, they argue that even in such case, communicating social norms might still enhance the internalization of the norm in the long run, turning it into a personal norm. Then, an activation of appropriate, preexisting norm is required. Based on Schwartz's (1977) NAM, this activation depends on increasing one's awareness of consequences, and the ascription of one's responsibility for those consequences. There are various ways to promote awareness of consumption consequences and to assign responsibility to them. Carlsson-Kanyama and Faist (2000) suggested informing consumers about the environmental consequences of their consumption choices, for example by creating a green consumer guides. Similarly, Hertwich (2005) suggests the use of an online or downloadable calculator for environmental impacts in order to raise awareness and assist consumers with making informed choices. Other programs to increase awareness include educational programs and campaign, such as those used for the downstream approach for habit change (described above).

Focusing on both AC and AR might lead to substantial results on both individual and institutional levels, for example emphasizing the connections between the meat industry and the ethical, health and environmental impacts that are assigned to it. For example, it might address the ignorance towards the treatment on animals discussed in chapter 3.1.

On an individual level, this can result in a decision of one to withdraw her/his support of the meat industry. On an institutional level, it might lead to better regulations that accurately relate to several moral aspects. For example, NOAH (2011) emphasize that while the impact of meat consumption on the environment has been established by extensive research and global reports, this impact is still widely ignored. They argue that such ignorance has been recently exhibited by Norwegian ministry of agriculture through the main message of the White Paper on Agriculture and food politics (Landbruks- og matdepartementet, 2011-2012).) which emphasizes the need to address two main topics: one is an increase of food production that would suit the growing population, including the increase of animal-products; the other is limiting climate change by focusing on sustainable production and an reduction of GHGs. With the meat industry being a major contributor to GHGs emissions, such message holds a fundamental paradox.

6.4 Further research

Suggestions for further research include a deeper understanding of the perception of meat in the Norwegian context. Relating to addressing the limitations described above, future research should include a larger and more representative sample, both in quantity of people and a larger scope of regions in Norway. Incorporating a more profound knowledge of specific characteristics of Norwegian consumption and situational parameters would be contributing to a more accurate analysis. For example, accounting for particular Norwegian tradition and customs might lead to a better analysis of the part of social norms and culture in food purchase decisions, and relating to specific estimation of the availability and accessibility of non-meat productsand the level of familiarity of them among Norwegian population. In addition to a better understanding of meat consumption in Norway, such context-specific parameters could lead to focused interventions. Moreover, it would be interesting to further investigate the facilitators and barriers to relating the behaviour of meat consumption to its effects on ethical aspects, health aspects and environmental impacts, for both individual and institutional levels. Finally, further research could focus on the evaluation of various interventions in Norway.

7. CONCLUSION

Reduction of meat consumption is a behaviour that can generate a substantial change: it may bring a significant reduction of human burden on the environment, it may improve individual's health state, and it may reduce animal and human exploitation.

This paper is an interdisciplinary paper integrating aspects of industrial ecology and psychology. On the psychological level, it aimed at discussing the facilitators and barriers for individuals' meat consumption in Norway. A model formed a model a theoretical model based on the theory of planned behaviour (Ajzen, 1991), the norm activation theory (Schwartz, 1977) and protection motivation theory (Rogers, 1977, 1983), and questionnaire study took place in Trondheim, Norway, with a sample of 209 participants. Health beliefs, attitude and general approach towards environmental issues were found as facilitators for reduction of meat consumption, while meat eating habits was found as barrier. Though moral beliefs did not show a significant relation to intention or behaviour, they might be considered as facilitators as well, for example due to possibility that they are reflected through attitudes. Then, based on the results for variables that affect moral beliefs, awareness towards environmental impacts and the media influence can be accounted additional facilitator and barrier to a reduction of meat consumption, respectively.

On the IE level, this paper presented the topic of meat consumption in a broader system perspective and focused on the relation between meat consumption and environmental degradation. The meat industry was found as a major contributor to environmental impacts on all impact categories, including GHGs, land use, water depletion and pollution and biodiversity.

A shift in dietary choices may reduce the impacts of the meat industry substantially. Individuals have the opportunity to take action and address the problems attributed to meat consumption simply by not supporting the meat industry. The extended system of meat consumption and production provide various opportunities for effective interventions that to support such reduction. These interventions can be applied for changing the behaviour of individuals or industrial and political institutions. For individuals, such interventions mainly address one's dietary choices and may use tools to empower individuals to make informed choices, such as awareness rising, information

distribution and educational campaigns; for institutions, such interventions focus on changes in regulations, the use of commant- and- control methods and economic incentives.

This paper pointed out three main aspects as reasons to support a reduction of meat consumption: ethical and moral reasons, health reasons and environmental impacts. While all of them clearly articulate the connection between meat consumption and undesired, severe consequences, these connections are often missed on the practical level. A better induction of these consequences in the process of decision making regarding food choices is needed in order to bring a fundamental change in food choices on both individual and institutional level.

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PERCEPTIONS OF MEAT CONSUMPTION IN NORWAY
QUESTIONNAIRE SURVEY

The purpose of this survey is to assess perceptions of meat consumption in Norway, with respect to topics such as habits, environment, health and social aspects. Results from the survey will be used in my master's degree thesis at the Norwegian University of Science and Technology (NTNU).

Participation is voluntary, and all participants are anonymous. A few background details are asked for, but none of them can be used to identify you.

Please note that there are no «correct» or «incorrect» answers to the questions in this survey, as our interest is in your personal opinions and points of view.

Thank you for your cooperation,

Ifat Zur, Master's Degree Student

Christian Klöckner, Professor, Supervisor

NTNU
Innovation and Creativity

Department of Psychology

READ THIS BEFORE YOU START.	This form will be automatically read. Please follow these instructions: • Use a black or blue ball point pen. Write clearly. Mark boxes like this: ☒. • Errors may be cancelled by filling the box completely. • Mark one box only per question unless otherwise instructed.

NOTE: To participate in this survey, you must have lived in Norway at least two years. If you have lived in Norway less than two years, please return the form without answering the questions.

CAPITALS ONLY, one character per field.

1. Your gender: ☐☐☐☐☐☐☐☐☐

2. Your age: ☐☐

3. Are you a student? No...... ☐1 Yes .... ☐2

4. If you have moved to Norway, how many years have you lived in this country? ⇨ ☐☐

5. How often do you eat meat? ⇨

   Please mark one box only.

   Daily .... ☐1
   One or more times a week .. ☐2
   Sometimes .... ☐3
   On special occasions .... ☐4
   Rarely........................ ☐5
   Never......................... ☐6
   I am a vegetarian .... ☐7
   I am a vegan .... ☐8

6. If you have moved to Norway: On a scale from 1 to 7, how has your meat consumption changed since you came here? ⇨

I eat much less meat		No change			I eat much more meat	
1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

7. Generally, how often do you eat out (in restaurants, coffee shops, etc.)? ⇨

   Daily .... ☐1
   One or more times a week .. ☐2
   Sometimes .... ☐3
   On special occasions .... ☐4
   Rarely........................ ☐5
   Never......................... ☐6

8. Who does the food shopping in your household? Please reply using the scale from 1 to 7. ⇨

I do it all		I do about half			Others do it all	
1	2	3	4	5	6	7
☐	☐	☐	☐	☐	☐	☐

KS-11 59-5 | E | This survey is conducted with the assistance of SVT-IT, NTNU | 1

Before continuing: Check that you have not accidentally omitted anything on this page.

9. On a scale from 1 to 7, to what extent do you agree
   or disagree with the following statements?

	Strongly disagree 1	2	3	4	5	6	Strongly agree 7
1. Reducing the amount of meat in my diet will require a lot of effort from me (*Please skip this question if you never eat meat*)	☐	☐	☐	☐	☐	☐	☐
2. It is difficult for vegetarian people in Norway to eat in restaurants	☐	☐	☐	☐	☐	☐	☐
3. My family thinks that meat is an essential part of a diet	☐	☐	☐	☐	☐	☐	☐
4. Eating meat is a strong part of Norwegian culture.	☐	☐	☐	☐	☐	☐	☐
5. Eating meat is something I do automatically (*Skip if you never eat meat*)	☐	☐	☐	☐	☐	☐	☐
6. Becoming a vegetarian would be easier if there were more vegetarian dishes available in restaurants and cafeterias	☐	☐	☐	☐	☐	☐	☐
7. The meat industry is cruel	☐	☐	☐	☐	☐	☐	☐
8. Meat consumption is one of the main environmental problems	☐	☐	☐	☐	☐	☐	☐
9. Animals in the meat industry are very well treated	☐	☐	☐	☐	☐	☐	☐
10. The meat industry is responsible for deforestation	☐	☐	☐	☐	☐	☐	☐
11. A meat based diet is more environmentally friendly than a vegetarian diet	☐	☐	☐	☐	☐	☐	☐
12. Consuming high amounts of meat might cause serious health problems	☐	☐	☐	☐	☐	☐	☐
13. A vegetarian diet can help reducing the risk for heart attacks	☐	☐	☐	☐	☐	☐	☐
14. Not eating meat will make me sick	☐	☐	☐	☐	☐	☐	☐
15. Eating beef puts me in risk of getting "Mad Cow Disease"	☐	☐	☐	☐	☐	☐	☐
16. If more people demand vegetarian food, its availability will rise	☐	☐	☐	☐	☐	☐	☐
17. I am confident that if I wanted to, I could reduce meat in my diet	☐	☐	☐	☐	☐	☐	☐
18. I am less vulnerable than other people my age to get a heart disease	☐	☐	☐	☐	☐	☐	☐
19. Eating meat is something I do without thinking (*Skip if you never eat meat*)	☐	☐	☐	☐	☐	☐	☐
20. My individual choices matter	☐	☐	☐	☐	☐	☐	☐

Note: On questions 11 through 14, please write 0 if none.

10. How many vegetarians do you know (family, friends, colleagues, etc.)? ⇨ ☐

11. How many people do you know who are limiting their meat consumption? ⇨ ☐

12. Out of them, how many are your family members? ☐   13. … close friends? ☐

14. Does your partner limit her/his meat consumption? ⇨
    No ...... ☐₁   I do not have
    Yes..... ☐₂   a partner .... ☐₃

15. Does your school/workplace have a cafeteria? ⇨
    No ...... ☐₁   I am not a student and not
    Yes .... ☐₂   working at the moment .... ☐₃

16. On a scale from 1 to 7, to what extent do you consider the following statements true of false?

	Definitely false						Definitely true
	1	2	3	4	5	6	7

1. Reducing meat consumption would affect my relationship with my family (*Skip if you never eat meat*) .... ☐ ☐ ☐ ☐ ☐ ☐ ☐

2. If I became vegetarian, my social life would be damaged .... ☐ ☐ ☐ ☐ ☐ ☐ ☐

3. People who are important to me think that I should eat meat.................................. ☐ ☐ ☐ ☐ ☐ ☐ ☐

4. My friends and family will support me if I choose to change my diet so that it includes less meat (*Skip if you never eat meat*) .... ☐ ☐ ☐ ☐ ☐ ☐ ☐

5. Compared to other industries, the meat industry is generating large amounts of waste .... ☐ ☐ ☐ ☐ ☐ ☐ ☐

6. I see many advertisements for meat products in the media .... ☐ ☐ ☐ ☐ ☐ ☐ ☐

7. I see many advertisements for vegetarian products in the media.................... ☐ ☐ ☐ ☐ ☐ ☐ ☐

8. Human behaviour has a strong impact on the environment .... ☐ ☐ ☐ ☐ ☐ ☐ ☐

9. I am interested in learning about ways to reduce my environmental impact.............. ☐ ☐ ☐ ☐ ☐ ☐ ☐

10. In comparison to other industries, the meat industry does not have much effect on air pollution .... ☐ ☐ ☐ ☐ ☐ ☐ ☐

11. I do not think about the impact of meat eating on the environment when I make my food choices (*Skip if you never eat meat*) .... ☐ ☐ ☐ ☐ ☐ ☐ ☐

12. Compared to other industries, the meat industry has a high impact on biodiversity...................... ☐ ☐ ☐ ☐ ☐ ☐ ☐

We would like to know your opinions on the following statements/ questions. Please reply using the scale from 1 to 7.

17. I think that environmental issues are … ⇨

	not important						very important
	1	2	3	4	5	6	7
	☐	☐	☐	☐	☐	☐	☐

18. Introducing more vegetarian dishes into my diet would be … (*Skip if you never eat meat*) ⇨

	unpleasant						pleasant
	1	2	3	4	5	6	7
	☐	☐	☐	☐	☐	☐	☐

19. In my opinion, including ethical considerations when making food choices is … ⇨

	a bad idea						a good idea
	1	2	3	4	5	6	7
	☐	☐	☐	☐	☐	☐	☐

20. How much do you care what your friends would think if you changed your eating habits? ⇨

	Not at all						Very much
	1	2	3	4	5	6	7
	☐	☐	☐	☐	☐	☐	☐

21. In comparison to a meat based diet, a vegetarian diet is … ⇨

	less expensive						more expensive
	1	2	3	4	5	6	7
	☐	☐	☐	☐	☐	☐	☐

22. How familiar are you with vegetarian dishes? ⇨

	Not at all familiar						Very familiar
	1	2	3	4	5	6	7
	☐	☐	☐	☐	☐	☐	☐

Before continuing: Check that you have not accidentally omitted anything on this page.

23. In the near future, I may consider to …

	No 1	*Yes* 2	*I am already* *doing that* 3
1. … stop eating meat products completely (vegetarianism)	☐	☐	☐
2. … stop eating animal products completely (veganism)	☐	☐	☐
3. … stop eating selected animal products completely (e.g., red meat)	☐	☐	☐
4. … limit my meat consumption to special occasions	☐	☐	☐

24. If you have any thoughts regarding meat consumption in Norway, please share them here. ⇩

Thank you for sharing
your opinions.

Appendix 2: Pattern matrix of the 13 extracted factors, including factor loadings, variance and eigenvalues

Variables	Component												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Animals in the meat industry are very well treated	**-.72**	.09	-.10	-.08	.08	.19	.02	-.07	.01	.10	-.07	.04	.03
Compared to other industries, the meat industry is generating large amounts of waste	**.71**	-.03	-.11	-.13	.07	.22	-.07	.06	-.07	.01	-.16	.07	-.07
The meat industry is cruel	**.59**	.00	.06	.08	.16	-.14	.08	.07	.00	-.04	.03	-.12	.18
Is including ethical considerations in food choices a good idea?	**.41**	-.08	.11	-.34	.14	-.11	.03	-.13	.04	.10	.30	-.06	.01
Compared to other industries, the meat industry has a high impact on biodiversity	**.41**	.01	-.02	-.16	-.03	.00	.29	-.09	-.12	.28	-.07	-.21	-.01
In comparison to other industries, the meat industry does not have much effect on air pollution	-.35	-.09	.27	.05	-.06	.00	-.01	-.19	.23	.08	-.08	.28	.30
Reducing meat consumption would affect my relationship with my family	-.11	**.80**	-.02	-.16	-.10	.08	-.12	.10	.04	-.02	.03	-.04	.13
If I became vegetarian, my social life would be damaged	.02	**.70**	.02	-.12	-.19	.12	.00	-.08	-.14	.00	-.10	.03	.00
My friends and family will support me if I choose to change my diet so that it includes less meat	.02	**-.69**	.06	-.19	-.08	.20	.00	-.07	-.10	.03	-.10	.07	.21
I am confident that if I wanted to, I could reduce meat in my diet	-.02	-.28	**.62**	-.12	.14	.05	.09	-.04	.18	.10	.19	-.13	-.06
It is difficult for vegetarian people in Norway to eat in restaurants	.09	.28	**.59**	.11	.15	-.21	.01	.18	-.15	-.12	.08	.14	.20
If more people demand vegetarian food, its availability will rise	-.17	-.15	**.46**	-.23	-.16	-.08	.06	.13	-.23	.04	-.15	-.39	-.06
Becoming a vegetarian would be easier if there were more vegetarian dishes available in restaurants and cafeterias	.09	.03	**.43**	.11	.00	-.12	-.05	.34	-.12	.38	.07	-.12	.03
I see many advertisements for meat products in the media	.28	.04	**.43**	.04	-.05	.38	.10	.04	-.04	-.15	-.03	-.04	.23
Human behaviour has a strong impact on the environment	-.02	-.03	-.04	**-.79**	-.08	.03	-.04	.17	-.10	-.11	-.19	.04	.03
I am interested in learning about ways to reduce my environmental impact	.08	.06	-.07	**-.74**	.18	-.06	.02	-.06	-.01	.10	.14	-.03	.07
Importance of environmental issues	.01	.17	.08	**-.63**	-.01	-.28	.17	-.09	.11	.10	.26	-.10	.02
Eating meat is something I do without thinking	-.12	-.01	.03	-.04	**-.78**	.02	.05	-.05	-.06	-.07	.11	.04	-.07
Eating meat is something I do automatically	-.06	.10	.07	-.08	**-.77**	.00	.06	.02	.15	-.18	.01	-.02	-.02
Reducing the amount of meat in my diet will require a lot of effort from me	.04	.11	-.21	.20	**-.74**	-.06	.03	-.06	.04	.24	.09	-.05	.13
Would introducing vegetarian dishes be considered as pleasant?	.11	-.01	.07	-.25	**.45**	-.10	.24	.20	-.05	.15	.10	-.09	.07
Familiarity with vegetarian dishes	-.08	.14	.04	.10	**.43**	-.02	.36	-.14	-.17	.10	.10	-.26	.02
My family thinks that meat is an essential part of a diet	-.03	.11	.31	.05	**-.42**	.03	.10	-.06	.13	.11	-.07	.16	-.32
I see many advertisements for vegetarian products in the media	-.13	-.01	-.02	.17	.01	**.76**	.18	-.02	-.02	-.06	.18	-.06	-.04
Extent of care for friends' opinion regarding one's change of eating habits	.07	.20	-.07	.03	.09	**.41**	-.30	-.08	.23	.38	-.22	-.15	.18
My individual choices matter	.02	-.12	.01	-.07	-.05	.19	**.73**	.08	-.02	.02	-.06	.02	.01
Consuming high amounts of meat might cause serious health problems	.07	.13	-.03	-.05	.08	.08	.01	**.79**	-.05	.10	.01	.10	-.02
A vegetarian diet can help reducing the risk for heart attacks	.04	-.07	.12	-.02	-.05	-.09	.06	**.64**	.18	.05	-.16	-.19	-.02
Amount of people known who are limiting their meat consumption	.01	.01	.04	-.04	-.01	.05	-.08	**-.11**	**-.87**	-.04	.01	.02	.00

(cont. 2)

Variables (cont.)	component												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Amount of known vegetarians	.09	.00	-.06	.05	.15	-.09	.23	**.04**	-.67	.19	-.12	-.07	.13
I am less vulnerable than other people my age to get a heart disease	-.09	-.09	-.01	-.03	.01	-.05	.04	**.13**	-.04	.81	.06	.12	-.02
Eating beef puts me in risk of getting "Mad Cow Disease"	.02	-.05	-.14	.07	.19	-.18	.05	**.20**	-.06	-.06	-.76	-.10	.05
People who are important to me think that I should eat meat	-.05	.45	.24	-.01	.20	.09	.17	**-.19**	.07	.04	-.45	.16	-.10
I do not think about the impact of meat eating on the environment when I make my food choices	.06	.05	.03	.07	-.24	-.18	.38	**-.13**	.25	-.09	-.39	.08	-.12
Not eating meat will make me sick	.01	.23	.01	.01	-.24	-.03	-.05	**-.27**	-.01	.27	-.33	.19	-.14
The meat industry is responsible for deforestation	-.01	.09	-.05	-.03	.04	.14	.06	**.10**	.06	-.04	-.04	-.78	.07
Meat consumption is one of the main environmental problems	.18	.00	-.07	-.06	.01	.11	.05	**.09**	-.13	-.07	.11	-.66	.05
A meat based diet is more environmentally friendly than a vegetarian diet	-.09	.10	-.22	-.05	-.01	.22	.33	**.21**	.11	.01	.07	.59	.01
Is a vegetarian diet more expensive than a meat based diet?	.03	.00	-.08	.11	.07	-.03	.03	**.06**	.05	-.02	.04	.02	-.82
Eating meat is a strong part of Norwegian culture	-.03	.09	.39	-.12	-.10	.27	-.16	**-.08**	.00	.10	-.07	.08	-.42
eigenvalues	7.225	2.67	2.35	1.86	1.73	1.61	1.52	**1.32**	1.28	1.22	1.45	1.06	1.03
variance	18.06	6.67	5.88	4.64	4.32	4.04	3.80	**3.29**	3.20	3.05	2.87	2.65	2.57
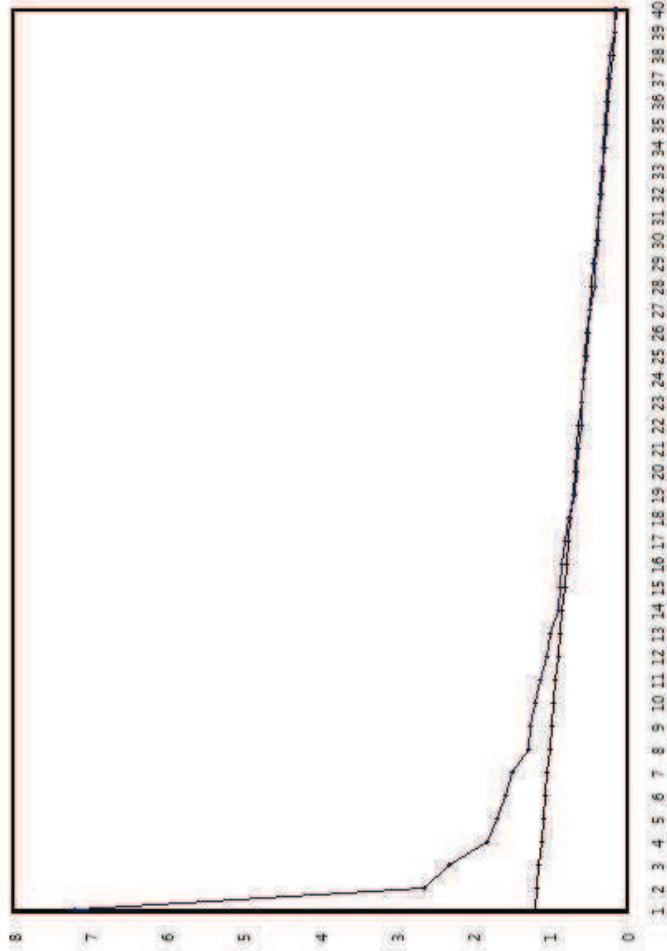
Appendix 3: Standard errors Scree plot