Sustainable food labelling

Progress and evidence on consumers and governance in a Swedish context

Master thesis

MSc in Engineering in Sustainable Cities at Aalborg University

Spring 2022

In collaboration with the Stockholm Resilience Centre and The French Organic Food and Farming Institute

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Abstract

Measures juxtaposing sustainability and human health of food products are in dire need to enhance diets in a Swedish context. This thesis elaborates on the potential benefits of implementing sustainable food labelling to orient Swedish consumers towards more sustainable and healthier food consumption. Credibility, clarity, and relevance of the information provided through sustainable food labelling were assessed and compared between four food labelling: the Planet-score, the Keyhole label, the KRAV certification, and the Sustainability Declaration of the Swedish retailer Coop. The transition theory is used to assess the extent to which sustainable food labelling can contribute to the transition towards sustainable and healthy diets. The nudge theory was utilized as labelling enables to empower consumers while upholding their freedom of choice. A survey was drawn up and disseminated to a sample of Swedish consumers but does not represent the Swedish population. Interviews were carried out to obtain expert knowledge. The study concluded that, to some degree, sustainable food labelling can influence consumers' diets. The format, the means of displaying, the trust in the information, and the harmonization of the scheme are essential aspects that need to be addressed to maximize the effectiveness of sustainable food labelling. As such, the design and the framework of the Planet-score appears to be relevant in a Swedish context. However, other parameters such as taste, or price are decisive in Swedish consumers' food choices. Sustainable food labelling is a tool that can potentially enable a transition, but it needs to be complemented with other initiatives.

Keywords: Sustainable food labelling, sustainable and healthy food consumption, Planet-score, sustainable and healthy food diets, food, choice, transition, nudge

Acknowledgement

First and foremost, I would like to offer my heartfelt thanks to Anne Charlotte Bunge, PhD Candidate at Stockholm Resilience Centre, for having supervised and supported me throughout this thesis. It has been a pleasure to work in collaboration with Anne Charlotte. I feel very thankful for her dedication and for all the relevant inputs she provided to me.

Additionally, a big thanks to the supervisors from my university, Arne Remmen, professor in the Department of Planning at Aalborg University, and Emil Pedersen, PhD candidate at Aalborg University. I deeply appreciated being supervised by Arne and Emil, who were very committed and active in the process of this thesis.

A special thanks to the Planet-score team, Sabine Bonnot, ITAB's chairman (the French Organic Food and Farming Institute), Hélène Lepetit, CEO of Very Good Future, and Fanny Cisowski, Project manager at ITAB, for their valued help to conduct this study.

Thank you to Elinor Hallström, manager for the area of expertise in Sustainable Nutrition at the Research Institutes of Sweden (RISE), for taking the time for an interview and the relevant insights concerning sustainable food labelling in Sweden.

Thank you to Martina Görnebrand, Principal Regulatory Officer in the department of EU Coordination and Export, and Bettina Julin, nutritionist at a department called Risk and Benefit Assessment at Livsmedelerket (Swedish Food Agency), for your time to be interviewed and the good points in the regard of sustainable food labelling in Sweden.

Thank you to all organisations which helped in the dissemination of the survey, it has been very helpful, inter alia, Swedish University of Agricultural Sciences (SLU), Slow Food Europe, and Mistra Food Systems.

Last but not least, I would like to deeply thank my parents, François Mingasson, and Mickaëlle Mingasson, who have always been available to help and advise me. I am very grateful for their support, this achievement would not have been possible without them.

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List of acronyms

ADEME – French Agency for the Environment and Energy Management
ANSES – The French National Health Security Agency
B2B – Business to Business
B2C – Business to Consumer
EC – European Commission
EU – European Union
FAO – Food and Agriculture Organization of the United Nations
FOP – Front of Pack
GHGE – Greenhouse Gas Emissions
GMOs – Genetically Modified Organisms
HCSP – The French High Council for Public Health
IDDRI – The French Institute for Sustainable Development and International Relations
IFOAM – International Federation of Organic Agriculture Movements
IPCC – Intergovernmental Panel on Climate Change
INRAE – French National Research Institute for Agriculture, Food and the Environment
ITAB – The French Organic Food and Farming Institute
LCA – Life cycle assessment
LCI – Life cycle inventories
LEAP – Livestock Environmental Assessment and Performance
NCDs – Non-Communicable Diseases
NGOs – Non-Governmental Organizations
PEF – Product Environmental Footprint
SDGs – Sustainable Development Goals
SFS – Sustainable Food Systems
UN – United Nations
WHO – World Health Organization

1. Introduction to sustainable food labelling

Food systems have the capacity to bolster human health and the flourishing of environmental sustainability, notwithstanding, that they are currently endangering both. The immediate challenge is to be able to provide healthy diets from sustainable food systems (SFS) to a growing global population. In 2019, 820 million people were suffering from insufficient food and many more do not eat high-quality diets, leading to micronutrient deficiencies and further diet-related diseases exposing numerous people to a higher risk of mortality and morbidity (Willett et al., 2019). Food systems are responsible for one-third of the global greenhouse gas emissions (GHGE) and are the main driver of biodiversity loss (Sindlinger & Siantonas, 2022). Food production is pushing manifold environmental systems and processes beyond their safe boundaries (Willett et al., 2019). When applying the conceptual framework of the planet-boundaries to the agricultural sector several limits are exceeded. It poses substantial issues in biodiversity integrity through genetic diversity, in biogeochemical flows through phosphorous and nitrogen cycles, and in novel entities through chemical substances such as pesticides, plastics or antibiotics (Persson et al., 2022). A transition of the global food system is in dire need (Willett et al., 2019).

To this end, the European Commission (EC) has committed to scrutinising a harmonized "*sustainable labelling framework*" including social, climate, environmental, and nutritional dimensions, in synergy with other pertinent initiatives, of food items. The EC is willing to enhance access to food information to empower consumers towards more sustainable and healthier food choices (European Commission, 2020a). Such initiative may also, to some extent, contribute to the fulfilment of the Sustainable Development Goals (SDGs) 12 and 13, especially target 12.8 and 13.3 (UN, 2015).

In 2021, aiming at aspiring towards a more sustainable food system, a new labelling scheme tackling sustainable parameters was released in France by The French Organic Food and Farming Institute (ITAB), the Planet-score. It is translating sustainable information through a main score and four sub-scores (ITAB, Sayari, & VGF, 2021). A colour-coded format with alphabetical order is used, similarly to the Nutri-score that was implemented in France in 2017 (ITAB et al., 2021; Santé Publique France, 2022). In Sweden, to this day, this type of labelling format is not utilized and the current well-known KRAV certification, and the Keyhole label (KRAV, 2022; The Swedish Food Agency, 2015), are built on a binary scheme which lacks transparency and understanding from consumers (The Swedish Food Agency, 2015). Hence, this thesis explores, through a consumer survey and expert interviews, whether a sustainable food labelling, such as the Planet-score, is adequate to orient Swedish consumers towards more sustainable and healthier diets?

2. Problem analysis of sustainable and healthy diets

This part elaborates on the current state of the global food system, outlining its incoherencies from a health, social, economic and environmental dimension. A focus is placed on the means of boosting the development of sustainable and healthy diets aiming at empowering consumers. Finally, governmental strategies are reviewed from a United Nations (UN), European, Swedish, and French perspective.

2.1. A worldwide broken food system

This section analyses two paradoxes of the current global food system, highlighting especially the various human health problems and the intertwined character of the food system with the environment.

Food systems refer to the sum of actors and interactions that are entailed in the food value chain – from input supply to farming including all agricultural commodities, to transportation, processing, trading, retailing, wholesaling, marketing, and cooking to consumption, and disposal. Policy environments and cultural norms around food are also integrated into food systems (IFPRI, 2022; WBCSD, 2021).

Nowadays, global food systems have reached a point where they are increasingly efficient as well as technologically advanced to deliver the number of food products needed to nourish the world's increasing population. For example, in 2017, cereal crop production had more than doubled since the year 1961 (IPCC, 2019). Nevertheless, food systems have also become an overarching international concern since they are contributing to a growing storm composed of climate change, hunger and malnutrition as well as substantial social inequities. Today, humanity is facing the challenge of providing healthy food while respecting the planetary boundaries, the socio-cultural aspect, and dedicating a focus on the most vulnerable and poorest population (Fanzo et al., 2022; The Lancet, 2019). Food systems in their current state are not contributing to the achievement of the SDGs (European Commission, 2020c; Fanzo et al., 2022). In that sense, two main paradoxes can be observed:

(1) the double burden of malnutrition – the existence of undernutrition (nutrient deficiencies, stunting, and wasting) in conjunction with overnutrition (nutrient deficiencies, overweight and obesity) (Fanzo et al., 2022; The Lancet, 2019); and food loss and waste (Fan, 2017; Fanzo et al., 2022).

(2) the looping fact that food production is not only contributing at large to environmental degradation but also being directly affected by it (Fanzo et al., 2022; McLaren et al., 2021).

2.1.1. Undernutrition vs overnutrition and food loss and waste

Undernutrition is a disaster that is striking a manifold amount of people worldwide. The trend over the past five years demonstrates that the number of hungry people is on the rise and in 2020, 811 million people were suffering from hunger (FAO, 2022). Subsequently, in 2020, approximately 2.37 billion people, i.e., roughly 30% of the world population, have been recorded as not having the accessibility to adequate food, which is an increase of 320 million people in comparison to 2019 (WHO, 2021b; Worldometer, 2022). As the World Health Organization (WHO) emphasizes, those food-related issues are also reaching children. In 2020, it has been assessed that, 45.4 million children were wasted (low weight-for-height) and that 149.2 million children below 5 years old were stunted (low height-for-age) (WHO, 2021b). To this day, the entire consequences of COVID-19 are difficult to appraise, nonetheless, it is odds-on that COVID-19 had and will continue to have negative effects on food security (World Bank, 2022). In addition to a large population that is coping with hunger, many, in opposition, are overnourished, causing further issues from a health perspective (EAT, 2019; McLaren et al., 2021). In this regard, the WHO underpinned that, in the last decades, the worldwide prevalence of obesity (referring to a body mass index higher than 30 kg/m^2) including adults aged 18 and over, has scaled up to reach 650 million adults in 2016. 38.9 million children under 5 years old were indexed as overweight in 2016 (characterized by a body mass index higher than 25 kg/m^2 or obese) (WHO, 2021b). Unhealthy diets and malnutrition are ranked among the top 10 risk factors that contribute to the global burden of disease (FAO and WHO, 2019). It is claimed that unhealthy diets present a higher risk of morbidity and mortality than tobacco, alcohol and drug use, and unsafe sex combined (WWF, 2020). However, it is worth noting that food is not the unique parameter accounting for chronic diseases. For instance, the type of lifestyle is also playing a significant role to fight obesity (WHO, 2021b; WWF, 2020).

Food loss and waste is also another incoherence contrasting with hunger as approximately 1.3 billion tons of food are lost or wasted each year. This represents 33% of the total amount of food produced annually (FAO, 2019).

2.1.2. Stimulation of food systems to climate change while being straightforwardly impacted by it

Food systems necessitate the utilization of various resources, and if not managed adequately, this can spawn environmental degradation and the exacerbation of climate change. Simultaneously, these two consequences can also adversely affect food systems in manifold ways, generating a "*snowball effect*".

2.1.2.1. Impacts of food systems on environmental degradation

Current food systems are generating severe environmental consequences throughout the whole food value chain. In this light, "*from farm to fork*", food is exacerbating freshwater use, climate change, land-use change and degradation, as well as biodiversity loss, to state a few (IPCC, 2019; McLaren et al., 2021). The food system is accountable for 21-37% of global GHGE. This approximation is encompassing emissions of 9-14% from crop and livestock activities, between 5-14% issued from land-use change and land use, and 5-10% coming from the supply chain. Agriculture within the farm gate solely is attributable to 20% of anthropogenic CO2-eq yr^{-1} (IPCC, 2019). Moreover, the main emitter of food-related GHGE is assigned to the production of animal products representing 72-78% of total agricultural emissions (Springmann et al., 2018). Although it is likely to add emissions to agriculture and land use, there is a lack of sufficient studies regarding emissions beyond the farm gate, i.e., for instance, upstream emissions from producing of fertilizers, or downstream emissions, with food processing, transport, retail, and consumption (IPCC, 2019). In 2020, five billion hectares were globally used by agricultural land area, i.e., 38% of the global land surface and out of this, approximately one third is utilized for cropland, and the two third left are used for grazing livestock (FAO, 2020). Blue and green water (water in surfaces such as lakes, oceans, groundwater reservoirs, and the water held in soils, respectively) used to grow livestock feed represents about 4,387 km^3 per annum, equalling approximately 41% out of the 70% of global freshwater withdrawals used in agriculture (FAO, 2017; Heinke et al., 2020). As a result, according to the type of food cultivated the embedded resources are not equal, shedding light on the high number of resources required to produce animal products. Ultimately, these environmental degradations and unsustainable use of resources are stimulating climate change-related events, inter alia, global warming, droughts, floods and jeopardizing a prosperous future for the next generations (IPCC, 2019).

2.1.2.2. Impacts of climate change on food systems

Food security is compromised by climate change on account of changing precipitation patterns, warming, and a higher frequency, severity, and duration of extreme events. Studies have appraised that climate change influences the quantity of food produced, with both direct effects, through crop yield, and knock-on repercussions, such as water quality and availability, pests and diseases, variation of the weather, and pollination services (IPCC, 2019).

Moreover, the change of weather can trigger direct consequences on food production due to the workforce's exposure to extreme conditions. As such, altering metabolic demands and physiological stress for labourers can also potentially create a dilemma about food availability.

To deal with those working conditions, people may need more food, meanwhile being unable to produce it. This may modify both cultural health and physical health, because of the change regarding the amount, quality, and safety of food available for people while being contextualized (IPCC, 2019).

Agricultural production, processing, and transport are also affected by solar radiation, humidity, wind, drought and, depending on the region, salinization and storm surge. Climate events may also trigger issues concerning the availability, access, utilization, and stability of food (IPCC, 2019).

Subsequently, a growing propensity in the literature has demonstrated that an increase in the level of CO2 in the atmosphere triggers a reduction of crucial nutrients for human health, such as protein, iron, B-vitamins and zinc in a large number of legume crops and cereals and an increase of the synthesis of carbohydrates such as starches and sugars (Eillie Anzilotti, 2019; Jessie Stolark, 2018). The knock-on effect of these disequilibria can result in anaemia and stunted development due to the lack of iron, a lack of appetite caused by zinc deficiency, and further issue in the process of converting food into energy issued by a low intake of B-vitamins (Eillie Anzilotti, 2019).

Consequently, while current food systems are having adverse effects on climate change, conversely, climate change is causing severe issues on food systems and ineluctably human health. To secure food safety for a growing population, it is essential that global food production is in harmony with the environment. This requires a transformation towards an SFS.

An SFS is defined as a food system that considers:

- Social perspective, i.e, public health, equitable value distribution, culture, traditions, social norms inclusiveness, livelihoods, education and skills, safety, animal welfare, institutions, nutrition and health (European Commission, 2020c; FAO, 2018),
- Economic angle, i.e, jobs, tax revenues, incomes, competitiveness, commercial viability, profits and food supply (European Commission, 2020c; FAO, 2018),
- Environmental aspects, i.e biodiversity & ecosystem services, climate change mitigation, carbon footprint & air quality, animal & plant health, water health & footprint, land use, soil health, animal and plant health, toxicity, and food loss and waste (European Commission, 2020c; FAO, 2018).

To nurture the booming of such a system, multiple transitions need to be operated at different stages of the food value chain. As one effective tool for sustainable and healthy diets, the EC proposed food labelling in the Farm to Fork strategy under the aegis of the European Green New Deal (European Commission, 2020a).

2.2. Food labelling, an instrument to develop sustainable and healthy diets

This section elaborates on a potential solution to address the challenges of the current food system previously outlined. It deals with various definitions of sustainable and healthy diets according to several organizations, and the potential impact of food labelling to empower consumers on their food choices aiming at guiding them towards sustainable and healthy diets.

2.2.1. Sustainable and healthy diets

As emphasized, in 2014, at the Food and Agriculture Organization of the United Nations (FAO)/ WHO Second International Conference on Nutrition, current food systems are more and more challenged to offer safe, adequate, diversified and nutrient-rich food for everyone contributing to healthy diets. The prevailing reasons are stresses caused by, among others, environmental degradation, natural resource depletion, and unsustainable production and consumption models (FAO and WHO, 2019). The Intergovernmental Panel on Climate Change (IPCC) is sharing this view by claiming that "*Consumption of healthy and sustainable diets presents major opportunities for reducing GHG emissions from food systems and improving health outcomes […]*" (IPCC, 2019, p.58). This leads to a dire need to foster diets that are nutritious, have low environmental impacts, are economically accessible, and are socio-culturally acceptable (FAO and WHO, 2019).

Under the auspices of the UN Decade of Action on Nutrition 2016 – 2025, a particular emphasis has been assigned to the transition of food systems with sustainable and healthy diets. In this light, in 2019, the FAO and the WHO have joined forces to meet the growing demands of countries regarding the composition of sustainable and healthy diets. To frame guiding principles, a systemic approach has been followed, taking into account "*international nutrition recommendations, the environmental costs of food production and consumption, and the adaptability to local, social, cultural and economic contexts*" (FAO and WHO, 2019).

As a result, sustainable and healthy diets have been defined as:

> "*[…] dietary patterns that promote all dimensions of individuals' health and wellbeing; have low environmental pressure and impact; are accessible, affordable, safe and equitable; and are culturally acceptable*" (FAO and WHO, 2019, p.9).

The purposes of sustainable and healthy diets are to reach adequate development and growth for every individual, that meets functioning and mental, physical and social well-being throughout the life stages including present and future generations. Subsequently, it must avert all types of malnutrition and foodborne diseases, such as micronutrient deficiency, undernutrition, overweight, obesity, and diet-related non-communicable diseases (NCDs), and promote the preservation, conservation, and restoration of biodiversity and planetary health (FAO and WHO, 2019).

These commitments are aligned with SDGs and commitments of the Second International Conference on Nutrition (FAO and WHO, 2019).

WHO points out that working on the burgeoning of sustainable and healthy diets is of high prominence as there is a close nexus between human health and planetary health. Furthermore, when it comes to evaluating environmental impacts, GHGE should not be the sole indicator considered, among others, land and water use needs to be included (WHO, 2021a).

Dietary guidelines of countries may also help countries to promote sustainable and healthy diets. From a health and environmental viewpoint, dietary guidelines should be indexed by food groups instead of nutrients (McLaren et al., 2021; WHO, 2021a). In that sense, nutrients may be a reductionist approach as depending on the food group, nutrients will not have the same effect and food items are not composed of a single nutrient. For instance, meat is not a unique source of protein, and fruits are not only a source of vitamins. A food product might be rich in one nutrient but lacking another, and vice versa, bringing evidence for a need to ingest a diversity of food items. Moreover, depending on the food group, the environmental impacts may vary (McLaren et al., 2021; WWF, 2020). WHO also place a focus on diminishing the amount of processed food consumed. As such, processing may have negative effects on nutrients, such as the destruction of vitamins or reducing the quality of proteins, which may trigger, inter alia, micronutrient deficiency. Processing food alters the food matrix impacting its nutritional value and hence, have ineluctably health effects, either positive or negative. Industrial processing, such as food fractionating and cracking, has been proven to be detrimental to human health (Fardet, 2014; Monteiro et al., 2018; Seferidi et al., 2020).

There also exist other parameters in food contributing to health such as satiety, pleasure, social and cultural exchange, and processing that can play a role in it. Further, processed food can be detrimental to the environment, for example, many of them are containing palm and soy oils, food additives, and lead to colossal amounts of waste through a packaging need that enables the "*manufacture, transport, and storage"* of this type of food (Monteiro et al., 2018; Seferidi et al., 2020, p.2). All these reasons justify the recommendation of WHO to urge member countries to reduce the consumption of processed food in diets (Fardet, 2014; McLaren et al., 2021). WHO advocates shifting dietary patterns towards more plant-based diets as these will translate into benefiting human health, reducing the environmental impacts, and saving billions of euros across Europe in healthcare costs (WHO, 2021c, 2021a). Thus, food is inherently multi-functional, and a systemic approach must be followed to establish sustainable dietary guidelines to strengthen synergies and minimize trade-offs (McLaren et al., 2021).

The EAT-Lancet Commission claims that, in 2019, there were still no global agreements on the constitution of healthy diets and sustainable food consumption and production. Notwithstanding, they have articulated a "*win-win*" solution including the human health aspect and environmental sustainability, called "*Planetary Health diets*" to emphasize that:

"[…] diets play in linking human health and environmental sustainability and the need to integrate these often-separate agendas into a common global agenda for food system transformation to achieve the SDGs and Paris Agreement." (EAT, 2019, p.7).

Their description of sustainable and healthy diets is in accordance with the one from the FAO and WHO as they champion shifts towards mostly plant-based dietary patterns as well as a transformation of the food production system to safeguarding the environment (Appendix A).

Albeit not explicitly stated in the FAO, WHO, and EAT definition of sustainable and healthy diets, human rights are also a parameter that is substantial in sustainability. Human rights should be protected and respected along the food value chain and forced and child labour, as well as modern slavery and human trafficking, must be eradicated. Working conditions should ensure the safety, health and well-being of workers (WBCSD, 2021).

In conclusion, recently, a lot of knowledge has emerged on sustainable and healthy diets among the scientific community evidencing its significant potential to contribute to SFS. But how can this academic knowledge be disseminated and understood by everyone?

2.2.2. Food labelling as part of food environments

This section touches upon how food environments can influence consumers' choices with an emphasis on food information. It will dig into the role of food labelling to allow consumers to make conscious choices.

Human-built and social environments are parameters shaping food environments. They refer to the social, cultural, economic, physical and political indicators that affect the availability, adequacy, and accessibility of food as part of a community or a region. Therefore, they can influence consumers' diets (Rideout, L.Mah, & Minaker, 2015). Food environments can be separated into four categories:

- "*Community food environments*": It is characterized by the geographical access or the variety and density of different food items available within a definite area.
- "*Organizational food environments*": It is measured by the characteristics, for example, food preparation, bulk options, or retailing in institutional settings.

- "*Consumer food environments*": It relates to consumer information, for instance, discounts, and the highlight of factors for consumers such as healthy, or sustainable products. It is also linked to the price, variety, quality, and availability of food.
- "*Food information*": It refers to labelling, advertising, educational curricula, and every other form of knowledge provided to consumers (Rideout et al., 2015).

As part of this thesis, the focus is placed on consumer food environments and food information, and especially on food labelling, as this can be a critical aspect in the choice architecture that may potentially have long-term effects (Thorndike, Riis, Sonnenberg, & Levy, 2014). Food labels, food labelling, and food certification are closely related, so, it is important to distinguish the three terms. The joint FAO WHO Codex Alimentarius Commission defines a food label as:

> *"[…] any tag, brand, mark, pictorial or other descriptive matter, written, printed, stencilled, marked, embossed or impressed on, or attached to, a container of food*." (Codex Alimentarius Commission, 2018, p.2)

food labelling as:

> *"[…] any written, printed or graphic matter that is present on the label, accompanies the food, or is displayed near the food, including that for the purpose of promoting its sale or disposal."*(Codex Alimentarius Commission, 2018, p.2).

(Dankers & Liu, 2003) defines a food certification as "A *procedure by which a third party gives written assurance that a product, process or service is in conformity with certain standards*" (Dankers & Liu, 2003, p.xiii).

The difference between the three terms stands in the actor that is providing the information. A label or labelling may or may not be controlled by a government agency while certification is regulated by an agency/ third-party (Choi, 2014; Dankers & Liu, 2003).

Food labelling can be a relevant means to communicate information to consumers, depending on the labelling format, content, and context (Rayner et al., 2013). One of the overarching goals of food labelling is to provide information to the largest number of consumers (FAO, 2016). Some labelling is found more or less useful due to its formats. For instance, the list of ingredients or the nutrition declaration are made more on an informative basis rather than on nutritional or production information as it is not intuitive and requires background knowledge. Further, the content is by evidence prominent, as long as it is veracious. The context whereby labelling is proposed is also substantial to its usefulness. If consumers do not trust the information, food labelling is consequently meaningless (Rayner et al., 2013).

In addition to being a wellspring of information, food labelling is also a source of marketing asserts by food producers. While providing potential information to consumers, labelling can also mislead consumers when it comes to purchasing, for instance, labelling can promote the richness of a certain nutrient of a food item while neglecting other, less desirable nutrients or health impacts (Albert, 2016; Rayner et al., 2013).

In this regard, food labelling can be an appropriate tool to translate and ease complex scientific information to empower consumers on their food choices, and ultimately on their desirability, as it creates a direct communication nexus between scientists and consumers (Downs, Ahmed, Fanzo, & Herforth, 2020; Thorndike et al., 2014). The type of information provided can be varied, namely, nutrition aspect, environmental information, production type, and working conditions, to highlight a few. Labelling can be implemented on a voluntary or mandatory basis and several stakeholders such as governments, non-governmental organizations, industry-funded bodies, think tanks, academia, and associations, can find agreements on the format, content, metrics, and context to facilitate consumers' comprehension and comparison (FAO, 2016).

This thesis focuses on the practice of science to classify food products, i.e food taxonomy, through labelling, and more precisely on sustainable issues. This can be implemented and eventually harmonized through various stakeholders at different levels.

2.3. Policy strategies and governmental efforts towards food labelling to achieve sustainable and healthy diets

This section tackles measures and actions ensued from a governmental perspective to develop sustainable and healthy diets. First, the work of the UN through the SDGs is introduced. This is followed by outlining the commitment of the EC to the "*Farm to Fork Strategy*". Lastly, the national vision of Sweden and France is presented.

2.3.1. United Nations strategy: Sustainable development goals

In 2015, to boost the flourishment of a peaceful and prosperous future, and therefore, curb climate change, at the Conference of Parties 21 in Paris, the UN released a blueprint entitled: *Transforming our world: the 2030 Agenda for Sustainable Development*. The report is constituted of 17 strategic goals seeking to be achieved by 2030, supplemented by 169 targets, that have been ratified by 173 signatory nations. The two paradoxes underscored previously are directly tackled by four SDGs. The first paradox, concerning health issues, is straightforwardly dealing with SDG 2, SDG 3, and SDG 12. SDGs 12 and 13 can be defined as the two main SDGs having a key role in the second paradox that relates to climate change. SDGs can be perceived as a tool to address those two paradoxes and ultimately, lead to the implementation of SFS (UN, 2015).

Among other needs, such systems have to guide and influence consumers on their purchases so that they do informed choices from a human health perspective, as well as an environmental and societal aspect, thus aiming at promoting sustainable and healthy diets. As part of this thesis, two SDGs will be chiefly touched upon, namely SDG 12 "*Sustainable consumption and production*" and SDG 13 "*Climate action*", and especially targets 12.8 and 13.3:

"*By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature*" (UN, 2015, p.27).

"*Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning*" (UN, 2015, p.27).

Subsequently, it is substantial to emphasize the interconnectedness of the SDGs, i.e., working on SDGs 12 and 13 will also act on and benefit several other SDGs (figure 1).

Figure 1: SDGs involved in sustainable and healthy diets, own figure based on (UN, 2015)

2.3.2. European vision for sustainable food consumption

As previously outlined in section 2.1.2.2, the EC has a goal of nurturing the development of "*[…] a fair, healthy and environmentally-friendly food system*" (European Commission, 2020a, p.1). Through this action plan, the EC draws a vision with strong importance on harmonized definitions, and common requirements and principles for SFS and foods. As such, it is claimed that the association of labelling and certification regarding the sustainable performance of food products aligned with targeted incentives, will spawn a boom towards sustainable practices and consumption (European Commission, 2020a).

Sustainability standards will have an incremental raise so as to develop a congruent norm including all food products found on the European market (European Commission, 2020a). Standardized sustainable labelling will guide consumers, producers, and traders towards adequate decisions, and diminish the ambit for "*confusing, conflicting, and misleading claims*" as measurements, monitoring, assessments and reporting will be consistently performed by following a common methodology (Baldock & Hart, 2021, p.37). Hence one of the actions seeking at promoting sustainable and healthy food consumption of the *Farm to Fork Strategy* is a "*proposal for a sustainable food labelling framework to empower consumers to make sustainable food choices*" by 2024 (European Commission, 2020a, p.8).

As part of the development of sustainable labelling, the EC venture an ambition of considering environmental, climate, nutritional, and social perspectives, as well as options regarding animal welfare in synergy with other pertinent initiatives of food products. Such labelling would provide clear, and truthful information that may facilitate consumers to decide on sustainable and healthy diets which may trigger positive effects on their quality of life, health, and costs related to health. Thereby, the purpose of the uptake of this labelling is to empower consumers to make informed choices. In the quest for the provision of information for consumers, the EC will also cover innovative methods such as digital means (European Commission, 2020a).

Shaping such sustainable food labelling requires in-depth knowledge to consider all relevant parameters. Indeed, the backstage information ensues from a life cycle assessment (LCA). LCA is a systemic analysis appraising the potential environmental impact of a product or a service throughout the entire period of its life. This includes the production, use, and disposal phases, also called "*from cradle to* grave" (UNEP, 1996). In order to have a common measure regarding environmental aspects, the EC has established a "*Product Environmental Footprint Guide*". The Product Environmental Footprint (PEF) refers to a "*[…] multi-criteria measure of the environmental performance of a good or service throughout its life cycle*" (Manfredi, Allacker, Chomkhamsri, Pelletier, & de Souza, 2012, p.1). This report provides a methodology to model the impact on the environment of "*[…] the flows of material/energy and the emissions and waste streams associated with a product throughout its life cycle*" (Manfredi et al., 2012, p.1). In that sense, the PEF method may be an appropriate tool to build sustainable labelling for food products.

To this day, in the European Union (EU), only a few harmonized food labelling exists that tackle nutritional and some sustainable aspects. Some are implemented as part of an EU context, namely, the European Union organic logo[1], the nutrition declaration[2], the list of ingredients[3], and the food irradiation symbol[3]. Some are worldwide, such as Fairtrade[4].

Some are implemented across European countries, such as the Nutri-score[5] implemented in France, Belgium, Germany, Spain, the Netherlands, Luxembourg, and Switzerland or the keyhole[6], adopted by Sweden, Denmark, Lithuania, Norway and Iceland (European Commission, 2020b).

Thus, within Europe, a few labels are valid for all EU members or all European countries and there is momentum in cross-country collaboration concerning the development of common labelling. Nevertheless, to this day, there is no labelling scheme that addresses parameters of sustainability which is valid for all EU members or all European countries.

In the Nordic countries, such as Sweden, a lot of research on food patterns and ways to influence consumers on sustainable and healthy diets has been completed recently, and although being in accordance with the development of an EU harmonized food labelling, at the national level, the keyhole food labelling and KRAV certification remain prevailing (Röös et al., 2021).

2.3.3. Swedish vision for sustainable food consumption

The Swedish Food Agency accounts for one of the first countries to have elaborated food-based dietary guidelines, deeming human health and environmental sustainability, by following, for instance, the Planetary Health Diet of the Eat-Lancet Committee (Patterson, Eustachio Colombo, Milner, Green, & Elinder, 2021). Notwithstanding, the Swedish population is still suffering from food-related diseases such as NCDs (European Commission, 2021; FAO and WHO, 2019). On average, increasing the consumption of fruits, vegetables, legumes, whole grains and nuts intakes, and reducing added sugar, red meat, processed meat, starchy vegetables, and refined grains, would be essential for the Swedish society (Patterson et al., 2021).

[1] https://ec.europa.eu/info/food-farming-fisheries/farming/organic-farming/organic-logo_en
[2] https://ec.europa.eu/food/safety/labelling-and-nutrition/food-information-consumers-legislation/nutrition-labelling_en
[3] https://www.fao.org/fao-who-codexalimentarius/sh-proxy/es/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCXS%2B1-1985%252FCXS_001e.pdf
[4] https://info.fairtrade.net/what/the-fairtrade-marks
[5] https://solidarites-sante.gouv.fr/prevention-en-sante/preserver-sa-sante/nutrition/nutri-score/etudes-et-rapports-scientifiques/
[6] http://norden.diva-portal.org/smash/get/diva2:700822/FULLTEXT01.pdf

2.3.3.1. Diet-related impact on human health

In Sweden, in 2019, diet ranked third, after tobacco smoking and high blood pressure, in terms of risk factors driving morbidity and mortality combined (IHME, 2019). As Food Sustainability Index[7] emphasizes, in Sweden, the prevalence of over-nourishment is scoring 41/100 and the diet composition is obtaining a score of 32/100, and ranking respectively, 38th/78 countries and 72nd/78 (Economist impact, 2021). Overweight and obesity are overarching concerns in Sweden as, for instance, the prevalence of obesity has tripled compared to 1980, and the trend is still growing among adults and children (Folkhälsomyndigheten & Livsmedelsverket, 2017). Based on a study performed in 2020, 51% of the Swedish population aged 16-84, was suffering from being overweight or obese (Public Health Agency of Sweden, 2020). Diabetes is also indexed as a dominant diet-related health concern by WHO, the Public Health Agency of Sweden, and the Lancet Commission (Folkhälsomyndigheten, 2021; Stanaway et al., 2018; WHO, 2022) since, in 2017, unhealthy diets represented 32% of deaths ensued from type 2 diabetes. Unhealthy diets are also a major cause of cardiovascular diseases. As such, in 2017, roughly 43% of death from cardiovascular disease were linked to dietary risk factors (Stanaway et al., 2018). Additionally, these health issues have direct consequences on health-related costs, given that, the societal costs of obesity in Sweden have been estimated to be a yearly amount of 6.8 billion EUR (Folkhälsomyndigheten & Livsmedelsverket, 2017).

2.3.3.2. Diet-related health inequalities

It is important outlining that among social groups, significant health inequalities are observable which are increasing steadily. Indeed, a study shows that the population in Sweden with higher incomes, although they eat more animal products, they consume more vegetables and fewer snacks and sweets. The greater consumption of vegetables in Stockholm than in rural areas brings evidence regarding discrepancies based on regional differences. Moreover, overweight and obesity fluctuate according to education, income, gender, and age (Amcoff et al., 2012).

In 2020, the Public Health Agency of Sweden (Folkhälsomyndigheten) performed an analysis on adults aged 25-84 and accounted that overweight and obesity were affecting 67% of people with pre-upper secondary, 63% of people with upper secondary education, and 45% of people with post-secondary education (Folkhälsomyndigheten, 2021). Moreover, through a survey steered by Swedish municipalities, it turned out that in vulnerable low-income areas, approximately 30% of children were suffering from overweight or obesity (Sverigesradio, 2003). In high-income areas of Stockholm, the rate was six times as low, which could stem from differences in educational level and income of the parents (Sverigesradio, 2003). Gender is also a key driver since, among 16–84-year-olds, 43% of women and 57% of men were overweight or obese (Folkhälsomyndigheten, 2021).

[7] https://impact.economist.com/projects/foodsustainability/interactive-world-map/

Age is also contributing to differences, as among individuals aged between 16-29 years old, 29% were overweight or obese, compared to 46% of persons among 30–44-year-olds. Among people aged 45-64 and 65-84, 63 and 62% of them were reported as overweight or obese, respectively (Folkhälsomyndigheten, 2021).

2.3.3.3. Diet-related impact on the environment

Food production, on the one hand, is bringing positive effects through ecosystem services, such as, inter alia, provision of healthy and safe food, regulation of air quality, carbon sequestration, and pollination. On the other hand, it also contributes to manifold negative environmental impacts, namely pesticide residues in surface and groundwater, nutrient losses to air and water, over-harvesting of fish stocks, and GHGE to name a few.

As the production of food products has severe environmental impacts, it is crucial to touch upon the consumption perspective. In terms of climate impact, in Sweden, the estimated number of emissions per capita per annum is 1.9-2.0 t CO2eq based on consumption for the years 2011-2013, while the average of high-income countries is set at approximately 1.7 t CO2eq, i.e., the Swedish climate impact is high. As figure 2 shows, animal products are attributable to a high share of these emissions (WWF, 2020).

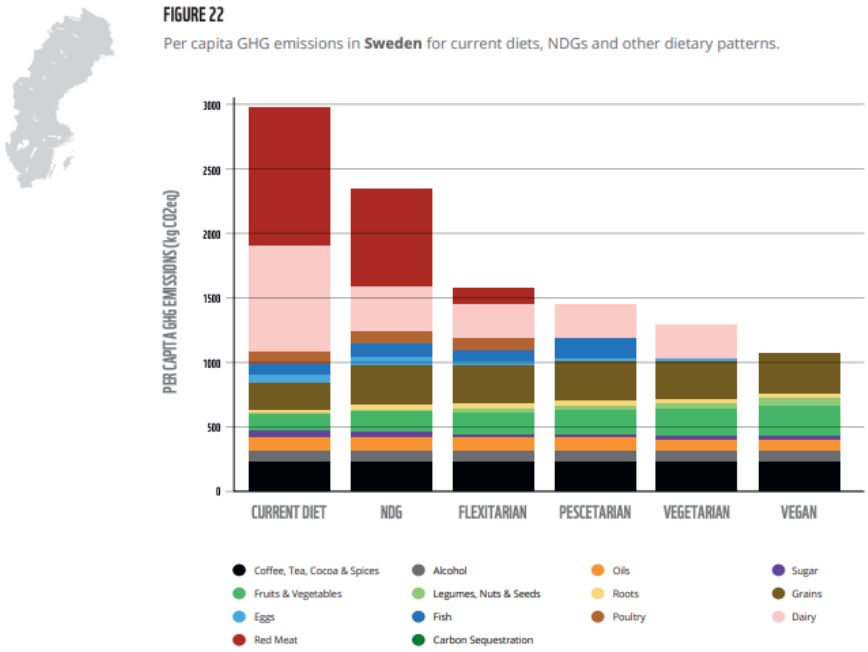

Figure 2: Graph showing the GHGE (in kgCO2eq) in Sweden, in 2020, per diet, per capita, and per food category (WWF, 2020)

Moreover, other parameters such as acidification and eutrophication potential, land use and human and ecotoxicity should also be added to climate impacts. When diets with low animal products are prioritized, it has been found that all impacts apart from toxicity had drastically decreased (Wood et al., 2019).

Through vegetarian and vegan diets, human and ecotoxicity impacts slightly scaled up, highlighting the need for a reduction of pesticide use (Wood et al., 2019). To curb these trends, although a decrease in the production has to be operated to reach climate targets, the Stockholm Resilience Center (SRC), WWF, and the Swedish Food Agency recommend to Swedish consumers a reduction of animal products, and especially red meat in their diets (Swedish Food Agency, 2019; Wood et al., 2019; WWF, 2020). As such, following a flexitarian diet, with mainly a reduction of red meat and dairy consumption, would result in almost halving emissions related to food consumption (WWF, 2020).

2.3.3.4. Towards sustainable and healthy food consumption in Sweden

The Swedish Food Federation is perceiving food labelling as a cornerstone for providing better options to consumers to make informed and sustainable choices aiming at adopting sustainable and healthy diets. The Federation qualifies an EU harmonized methodology to shape an integrated sustainability labelling of food grounded on solid evidence and pertinent criteria as "*a positive development*" (The Swedish Food Federation, 2021). Further, they claim that it might be an effective means to facilitate sustainable consumption, nevertheless, considering the existing extensive labelling regulations, the outset point should be an increase of information implemented on a voluntary basis (The Swedish Food Federation, 2021).
In Sweden, several labelling schemes exist on a voluntary basis, for instance, the Keyhole health label and the KRAV certification (Röös et al., 2021; The Swedish Food Federation, 2021). In this regard, before any new EU regulation on food labelling, the Federation is fostering a thorough analysis of the potential impacts on consumers, producers, and the entire sustainability impact triggered by such requirements. Subsequently, the Federation points out that it is prominent that new EU requirements do not undermine existing voluntary labelling "*[…] that work well […]*" in Sweden (The Swedish Food Federation, 2021, p.9).

In addition, the Mistra Sustainable Consumption report 1:10 calls for a harmonized framework for sustainability labelling that incorporates social, climate and other environmental indicators, as well as health aspects. Furthermore, negative labelling (mentioning that the item is worse than the average) is more likely to influence consumers than positive labelling (signal demonstrating that a product is better than another). The report also underlines that hierarchical labelling, i.e., when different levels (e.g., alphabetical letters, traffic lights) are used to inform on the impact of a product, can turn out effective and offer a potential shift in consumers' behaviour. A flaw raised on eco-labelling is that, according to Röös et al., it solely guides consumers towards the potentially best choice intra category of food products. As such, it is claimed that it does not affect important consumption changes inter categories of products, such as from red meat to vegetarian alternatives (Röös et al., 2021).

2.3.4. French vision for sustainable food consumption

In France, approximately 1 in 10 people is suffering from obesity, and almost 45% are overweight or obese. Although OECD projections plan an overweight rate increase of 10% within the next ten years, France remains among the EU countries with the lowest overweight rate. As in Sweden, socio-economic disparities are also noticeable. Indeed, women with low education have been assessed as being three times more likely to be affected by being overweight than women with higher education. Men with poor education are 1.6 times more likely to suffer from overweight compared to more educated men (OECD, 2021a). Poor nutrition, as in other countries, also turns out to be the overarching factor leading to overweight and obesity (OECD, 2021b). Under the consumption perspective, food is accounting for 23% of GHGE in households, 3% of the national energy consumed, and agriculture is the second GHG emitter representing 20% of national emissions. On average, a daily French diet is emitting 4 kg eq CO2/ day (ADEME, 2022).

To curb these health and environmental problems as well as socio-economic inequities, the French government decided to place a focus on the food environment and especially on food labelling to educate consumers.

In France, the concept of environmental labelling for food products has been under discussion for approximately 10 years. In 2012, through the Grenelle laws, a first experimentation came to light, and it was deduced that labelling was potentially useful for environmental issues but was complex to generalize in short term. Recently, there has been a boom in labelling, especially concerning the field of nutritional labelling (Brimont & Saujot, 2021).

As such, in the 2016 Health Law, the French Ministry of Health had the ambition to help consumers with nutritional information to orient individuals towards healthier behaviours by generating environments conducive to decent nutrition. The goal was to make nutritional information an element of food choice in the same way as brand, price, and presentation by providing understandable information on the front of the pack (FOP) of food products (Brimont & Saujot, 2021; Touraine, 2015). Thus, this begets the Nutri-score system (also described as 5-Colour Nutrition Label or 5-CNL) in 2017 created by Santé Publique France (Public Health France) (OECD, 2021b; Santé Publique France, 2022). In Europe, France is one of the front runners of food labelling as it is the second European country, after the United Kingdom, to implement a traffic light label system for nutritional information, ranging from green (grade A) to red (grade E) (WHO, 2017). A study comparing four different nutrient label systems demonstrated that this format turns out to be the most consumer-friendly scheme. The label is implemented on a voluntary basis and is intended for pre-packaged foods (Egnell et al., 2018). It converts the nutritional value of a product, through a scientific algorithm, into a code composed of 5 letters, each with its own colour.

The algorithm assigns points to the food product based on "*bad nutrients (energy, sugars, saturated fatty acids, salt)*" and "*good nutrients (proteins, fibre, percentage of fruit, vegetables, nuts, rapeseed oil, walnut oil and olive oil)*", and according to the overall point score, it provides a letter score (figure 3) (ColruytGroup, 2020). Products are indexed under four categories: 1) fats, oils, and butter, 2) cheese, 3) beverages, and 4) a general category with the rest of food products (de Petris & Warhem, 2021).

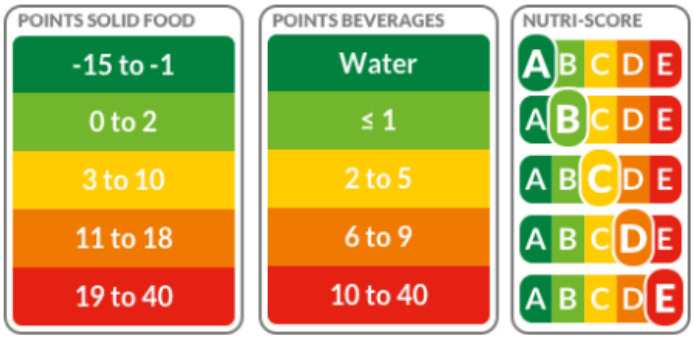

Figure 3: Calculation of the Nutri-Score (ColruytGroup, 2020)

Although presenting some flaws, such as an absence of details on diets, a neglection of additives and the processing of food, exclusion of products that do not fit under the four categories, and a lack of comparison inter-categories (de Petris & Warhem, 2021), the Nutri-Score turns out to have, to some extent, positive effects on consumers' food choices and has increasingly gained popularity (de Petris & Warhem, 2021; Hercberg, Touvier, Salas-Salvado, & on behalf of the Group of European scientists supporting the implementation of Nutri-Score in Europe, 2021; IARC & WHO, 2021; Ministère des solidarités et de la santé, 2021). For instance, in a study carried out in 2020 with a representative sample of the French population, 57% claimed having altered at least one purchase habits thanks to the Nutri-score, 93% found this label useful, and 93% had already "*seen*" or "*heard about*" this label (Ministère des solidarités et de la santé, 2021).

Following the European call for the establishment of a harmonized EU food labelling striving for human and planetary health, the Nutri-Score has been sent to the EC (EREN, 2021) and other food labelling emerged in France, such as the Planet-Score and the Eco-score which are shaped on the format of the Nutri-Score. Environmental labelling might not become mandatory in France, as it will be judged as impeding the freedom of movement of goods within the EU by other EU members (Brimont & Saujot, 2021).

2.4. Sub-conclusion

Food is a key component of human life and currently, global food systems are exacerbating climate change, hunger, malnutrition, and social inequities, and hence, are not congruent with the fulfilment of the SDGs. Two main paradoxes have been identified in the context of the current state of the art of the global food system, the coexistence of undernutrition, and overnutrition and food loss and waste, and the contribution of food systems to climate change while being directly affected by it. Sustainable and healthy diets have been assessed by various relevant organizations as holding the capacity to meet health, environmental, cultural, societal, and economic stakes. Food environments are key drivers to influence consumers' food choices, potentially through food labelling, by providing more transparency on various characteristics of food items enabling all consumers to make informed choices. The EC aims at proposing an EU harmonized food labelling that includes nutritional, environmental, climate and social aspects by 2024. The Swedish government is understanding the usefulness of such labelling and asserts that it will reduce foodborne diseases, social inequalities, and environmental impacts of food, nonetheless, they outline the prominence of the voluntary basis to be able to uphold the efficiency of their existing labelling. France has been a trailblazer regarding food labelling as, lately, several labels and labelling have been unveiled, such as the Nutri-Score, the Eco-Score, and the Planet-Score. The format and indicators of these scores have gained a consensus in the scientific community as well as within several EU countries and are, thereby, under discussion at an EU level. In that sense, such labelling could also benefit Sweden, by contributing to the transition towards sustainable and healthy food consumption. However, to develop a sustainable and healthy food labelling scientists' knowledge is required and consumers' perceptions and understanding need to be appraised.

3. Problem statement

The problem analysis demonstrated the current food system is responsible for several incoherencies, and inequalities, which turn out to be unsustainable and lack transparency for consumers. As current agricultural practices are significantly contributing to the exceeding of the planet's boundaries, there is a dire need to alter them in a way that safeguards the environment (Campbell et al., 2017). Consumers can be key actors to meet this stake through their food purchases. Nevertheless, the current prevailing food patterns are adversely affecting both human health and the planet, thus, jeopardizing the thriving of future generations (IPCC, 2019). This outlines the need for a shift of paradigm towards sustainable and healthy diets (European Commission, 2020a).

To this end goal, various strategies can be explored. The development of harmonized sustainable labelling scheme is claimed as a means by the EC to contribute to this transition by empowering consumers in their food choices (European Commission, 2020a).

France is a front-runner in food labelling in Europe, where two labelling schemes, the Nutri-score and the Planet-score with a similar format composed of a colour-coded and alphabetical order were, recently, released by the team of the professor Serge Hercberg, the French National Health Security Agency (ANSES) and the French High Council for Public Health (HCSP) (Santé Publique France, 2022); and ITAB, Very Good Future, and Sayari, respectively (Brimont & Saujot, 2021; ITAB et al., 2021). The Planet-score, implemented in 2021, is focusing on sustainable parameters and a quantitative study exhibited its potential to influence consumers towards more sustainable and healthier diets (ITAB et al., 2021). For this reason, France can serve as an inspiration for other EU member countries (FoodDrinkEurope, 2022).

To this day, in Sweden, there is no labelling scheme that can assess sustainable parameters for all food products. A few food labelling are currently used, however, they are mainly built on a binary scheme. In order to implement a comprehensive sustainable food labelling scheme, such as the Planet-score, it would be useful to understand consumers´ perception and behaviour in this regard. In that sense, it is pertinent to expose Swedish consumers to a new food labelling format assessing the sustainability of food products in order to appraise the extent to which it could potentially affect their food choices.

To address this, the objective of this project is threefold:

1) Examine the perception and potential of the Planet-score to Swedish consumers and the trust in food labelling based on the entity developing it.
2) Discuss the vision of sustainable food labelling from a scientist and governmental perspective in Sweden.
3) Capture relevant parameters that can be used in sustainable food labelling with an example of how to translate them in a clear and concise format.

Thus, the following main research question and sub-research questions have been drawn up and are touched upon throughout this thesis:

What is the role of food labelling in the quest of galvanizing Swedish consumers to adopt more sustainable and healthier diets?

- How would Swedish consumers react to a sustainable food labelling, such as the Planet-score, as part of the Farm to Fork Strategy?
- How would the format, the parameters, the feasibility and the developers of a sustainable food labelling, such as the Planet-score, be perceived in the Swedish governance?
- What are the limitations of sustainable food labelling, and how to overcome them?

4. Theoretical framework

This section addresses two theories, to wit the Transition theory and the Nudge theory. A presentation of them is carried out followed by a contextualization within this thesis.

4.1. Transition theory

In the 1990s, the concept of transition surfaced in the context of large-scale sustainability and societal change. In this regard, the increasing interest in tackling complex problems has fostered the burgeoning of the transition notion.
In essence, the term transition relates to the idea of changing from an equilibrium state to another caused by sporadic perturbations. Recently, the term transition has often been referred to as a system bereft of a sustainability perspective that seeks to become a more sustainable system (Loorbach, Frantzeskaki, & Avelino, 2017).

(Loorbach et al., 2017) discern three interconnected dimensions:

- "*Socio-Technical*" (ST) draws on science and technology
- "*Socio-Institutional*" (SI) builds on social sciences to address system changes in intricate societal systems
- "*Socio-Ecological*" (SE) elaborates on insight from biology, ecosystems services, ecology, and adaptive governance (Loorbach et al., 2017).

As part of this thesis, the ST aspect is relevant as food labelling is established through science and technology. As science and technology evolve, the quality and availability of information improve SI perspective is pertinent as behaviours, habits, routines, education, and awareness are topics related to food consumers. As such, the SI perspective is applied to societal systems coping with tenacious environmental challenges. It deems the role of governance and agency in the transition with a reflective process, the stakes of ambiguity, normativity, and social construction, as well as cultures, social learning and daily practices in transition dynamism. The SE dimension is also useful in this study, as in order to generate food labelling that addresses sustainable issues, data coming from the natural environment (biodiversity, ecosystems, etc…) needs to be collected (Loorbach et al., 2017).

(Tukker et al., 2008) claims that "*[…] consumers, in theory, can exercise sustainable choice*" where stimulation can be issued from campaigns and informative instruments (Tukker et al., 2008, p.1220). Nevertheless, in reality, social norms, infrastructures, and habits are locking in a large part of consumers in their choices (Stø, Throne-Holst, Strandbakken, & Vittersø, 2007).

Three components need to be tackled in conjunction to operate a behavioural change in consumers: (1) intent/ motivation, (2) ability, and (3) opportunity. The substitute opportunity should at least appear "*[…] as attractive as the existing way of doing things […]*" not solely regarding functionality but also in relation to immaterial features, e.g, identity creation, symbolic meaning and expectations (Tukker et al., 2008). However, to operate a change, the only utilization of informative instruments is not sufficient (Stø, Throne-Holst, Strandbakken, & Vittersø, 2007).

As part of this thesis, transition theory paired with the three perspectives, namely ST, SI, and SE, was appraised as adequate. Science and technology are needed to draw up sustainable food labelling. Moreover, the SI provides more information on food products to consumers and potentially contributes to a shift towards sustainable and healthy diets. Finally, SE fosters the collection of data to incorporate into the food labelling.

4.2. Nudge theory

The nudge notion in a raw sense means "*[…] to push mildly or poke gently in the ribs […]"* which can then be also understood as an alert, reminder, or a mildly warning to someone. (Thaler & Sunstein, 2008, p.4) use this term as: "*[…] any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives.*" (Thaler & Sunstein, 2008, p.6). In that sense, it is an intervention, that "*[…] must be easy and cheap to avoid.*", to influence the choice of a person (Thaler & Sunstein, 2008, p.6). For instance, placing fruits at the eye level of customers is a nudge but banning junk food is not (Thaler & Sunstein, 2008). In essence, nudge is designed to grasp the idea that human behaviour and decision-making are driven by biases and cognitive limits in a manner that may be used to peculiar behaviours (Hansen, 2016).

(Thaler & Sunstein, 2008) also describe an approach that is linked and can be paired with nudge, the "*libertarian paternalism*" defined as "*[…]an approach that preserves freedom of choice but authorizes both private and public institutions to steer people in directions that will promote their welfare*." (Thaler & Sunstein, 2003, p.179). As such, people do not have restrictions to exercise their freedom and can follow their own way, however, (Thaler & Sunstein, 2008) judge "*legitimate*" to move people's behaviour intending to enhance their lives. Libertarian paternalism is asserted to be, to some extent, a nonintrusive, soft, and weak type of paternalism as a result of unblocked, or significantly burdened choices. It is considered "*soft paternalism*" since the public and private choice architecture do not monitor or implement people's anticipated choices. Instead, it self-consciously guides people to make their lives better (Thaler & Sunstein, 2008).

Choice architecture can play a role when it comes to making a food choice as it has the possibility to change the various parameters such as the perception (e.g. emotional priming), the environment (e.g. social or olfactory), availability and accessibility of food (e.g. portion size, convenience), or knowledge-based changed (e.g. labelling) (Arno & Thomas, 2016; Cioffi, Levitsky, Pacanowski, & Bertz, 2015). Although the provision of factual information is "*[…] certainly a nudge but it may or may not qualify as paternalistic.*" (Thaler & Sunstein, 2008, p.6). According to (Arno & Thomas, 2016; Cioffi et al., 2015; Ensaff, 2021; Rozin et al., 2011; van Gestel, Kroese, & de Ridder, 2018), food labelling is a nudge as belonging to the food choice architecture. Adding a food labelling is a small change carried out on the pack or close to the product, that an individual can live with and maybe not even remark on a conscious level (Cioffi et al., 2015). Taking an example with the Planet-score, the fact the unhealthy and unsustainable products score in red will repulse people as red is associated with danger, therefore, consumers' unconsciousness will try to avoid it (Pravossoudovitch, Cury, Young, & Elliot, 2014).

Nudge theory coupled with the libertarian paternalism approach has been appraised as pertinent for this thesis as food labelling is perceived as a nudge practice. Hence, it transmits knowledge to consumers, while upholding the freedom of consumers in their purchases.

4.3. Sub-conclusion

The Transition theory comprises three facets, namely ST, SI, and SE. The three of them were found tailored to this thesis as dealing with science and technology, and social sciences, respectively. As such, science and technology are required to collect data on food products and translate them into sustainable food labelling. Social sciences need to be considered to appraise and maximize the effectiveness of the initiative aspiring to a transition towards more sustainable and healthier food consumption. Data on natural environment of food products are the roots to create a sustainable food labelling.
The Nudge theory, which relates to a modification in the choice of architecture that can have an impact on the behaviour of people while not banning any options or increasing tremendously the financial parameter, can be aligned with libertarian paternalism, which maintains the freedom of people in their choices and spire to improve welfare.

The juxtaposition of these two theories was evaluated as coherent on account that a nudge element can be an asset in a quest for a transition. As such providing more information to consumers may generate a potential shift from unhealthy and unsustainable diets to those more in harmony with the body's intake needs and the respect of the planet.

5. Methodology and Research Design

The following section outlines the methods applied and an explanation of their relevance in the context of this thesis. A description of the methods is provided in Appendix B. The research design, exhibited at the end of the section, gives an understanding of the framework of the thesis.

5.1. Literature review

Appendix B.1 comprises a general description of what is a literature review, its purpose, and the process of building a literature review.

As part of this project, a literature review was used as a baseline for the exploratory research to carry out the Problem Analysis. It helped to identify research gaps and formulate the Research Questions. Through this process, initial information on sustainable and healthy diets, and sustainable labelling from a European perspective as well as Swedish and French contexts were investigated.

5.2. Qualitative interviews – Semi-structured interview with Elinor Hallström, Martina Görnebrand, Bettina Julin, and Hélène Lepetit

Appendix B.2 provides a description of the objectives of leading semi-structured interviews and how it is performed.

Semi-structured qualitative interviews have been utilized to obtain insights from different experts working in the field of SFS.

In this thesis, three semi-structured qualitative interviews were conducted:

1) Elinor Hallström, manager for the area of expertise in Sustainable Nutrition at RISE Research Institutes of Sweden in the Sustainable consumption and production unit (Appendix F).
2) Martina Görnebrand, Principal Regulatory Officer in the department of EU Coordination and Export, and Bettina Julin, nutritionist at a department called Risk and Benefit Assessment at Livsmedelerket (Swedish Food Agency) (Appendix E).
3) Hélène Lepetit, C.E.O at Very Good Future (Appendix G).

All interviews were led through the online platform Zoom, and the interview guide was sent beforehand to the interviewees.

5.3. Quantitative study with Swedish consumers

5.3.1. Quantitative study

In this thesis, the use of a questionnaire was judged pertinent to investigate the influence that various food labelling can have on consumers' food purchases based on their format, transparency, and clarity as well as consumers' interest in sustainable food consumption. As such, the questionnaire was used from a B2C (business to consumer) perspective (Appendix C for the questionnaire).

Appendix B.3 provides a description of the data collected through a qualitative study.

5.3.2. Questionnaire design

A self-administered questionnaire was framed, and the respondent did not have any interactions with the authors that could have influenced their choices (Appendix C for the questionnaire). For the purpose of an efficient analysis, the same set of questions was distributed to all respondents (Saunders, Lewis, & Seo, 2015).

The questionnaire consisted both of closed-ended and opened-ended questions. The predefined responses were mainly grounded on the Likert scale which is a psychometric tool commonly used in social and educational sciences (Joshi, Kale, Chandel, & Pal, 2015). Two questions were framed on a comparative basis (closed-ended) and three of open-ended nature to obtain in-depth knowledge through respondents' opinions (Creshwell, 2014). A few questions were about intrinsic information.

The questionnaire was framed in four sections (see table 1), inspired by the quantitative study carried out by (ITAB et al., 2021). The survey was created on the Google form platform.

Table 1: Description of the sections of the questionnaire

Block variable	Description
1) Socio-demographics	Questions about the citizenship, gender, age, socio-professional category, education level, and current region of residence.
2) Consumption behaviour of food products	Question about the criteria driving consumers in their food purchases
3) Perception and potential of the Planet-score a) Perception and influence of the Planet-score b) Trust in food labelling c) Comparison of several food labelling	Questions about the perception of the Planet-score based on its format, indicators, and place of display. Questions about the confidence of the food labelling based on the entity developing it. Question about comparing different food labelling.
4) Intention to adopt more sustainable food consumption behaviours	Question about the willingness of consumers to adopt sustainable diets.

5.3.3. Data collection

Before the full sample dissemination of the questionnaire, a pilot study was conducted. In this regard, the questionnaire was sent out to a small-scale sample to test its feasibility, workability, and relevance. The pilot study identifies potential issues, flaws, and needs for adjustment (In, 2017). It was tested by supervisors from Aalborg University, Stockholm Resilience Center, and experts from ITAB.

The survey was circulated to the full sample by providing the link to the survey. Various contacts and organisations were reached out to help disseminate the survey, such as the Gothenburg Center for Sustainable Development, Stockholm Environmental Institute, Stockholm Resilience Center, Swedish University of Agricultural Sciences and Slow Food Europe to name a few. A self-administered online questionnaire is, to a lower extent, prone to be affected by social desire as the receiving audience is required to choose between predefined answers, in contrast to real-life interviews. Self-administered questionnaires present a risk of bias on account of a low number of responses which may turn out unrepresentative of the population (Saunders et al., 2015).

This questionnaire was open for 21 days from 21/04/2022 to 11/05/2022 and 57 answers were obtained. Five of them were from non-Swedish citizens, therefore, these were excluded from the analysis. Hence, 52 answers were analysed.

5.3.4. Data analysis

The questionnaire design of mixed closed-ended and open-ended questions required different type of analyses.

5.3.4.1. Closed-ended questions

To analyse the outcomes of closed-ended questions, all responses were exported to an excel spreadsheet. Then several aggregated graphics were carried out by taking inspiration from those established by (ITAB et al., 2021) (see section 7.1).

5.3.4.2. Open-ended questions

Open-ended questions were analysed based on the understanding and interpretation of the author. The answers were used to support the analysis section. The analysis of the answers was both performed on a quantitative and qualitative basis. It was carried out based on points that were raised several times by respondents, but also on specific aspects pointed out by single respondents.

5.4. Description of food labelling

As part of this thesis, the description of four food labelling, namely the Planet-score, the KRAV certification, the Keyhole label, and the Sustainability Declaration of Coop, was proceeded in order to provide background information on the food labelling investigated. A descriptive process was therefore utilized since the ending goal was to draw a comparison between different labelling and label schemes to assess their relevance in the quest of shifting consumers towards sustainable and healthy diets.

5.5. Research design

Figure 4 exhibits the framework of this thesis.

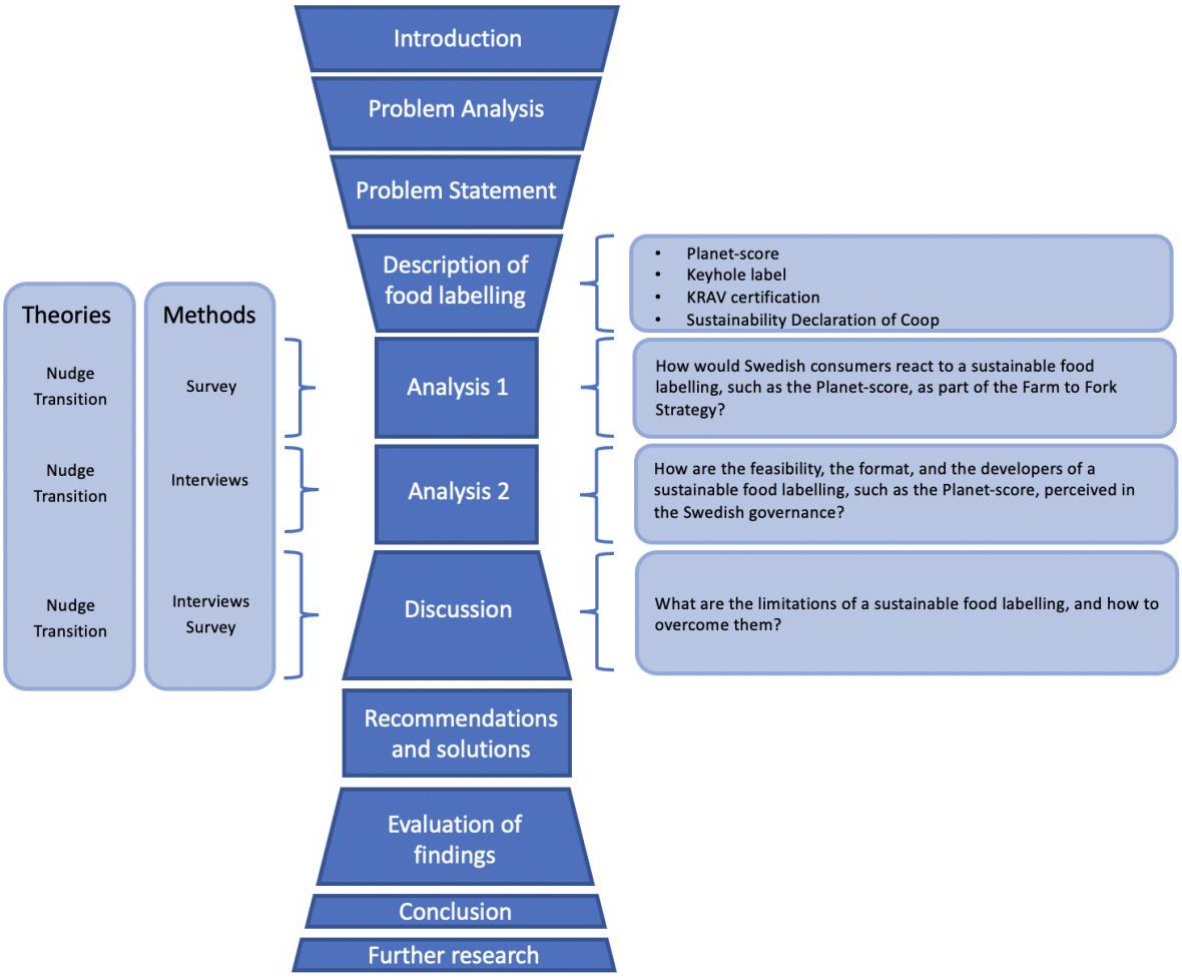

Figure 4: Research design (own model)

6. Description of four food labelling: the Planet-score, the KRAV certification, the keyhole label, and the Sustainability Declaration of Coop

In the context of nurturing the development of sustainable and healthy diets through the empowerment of consumers, food labels and food labelling turns out to be one of the adequate strategies to deal with this transition (European Commission, 2020a). In this section, a recently launched French food labelling scheme called Planet-score is introduced, two widespread food labelling in Sweden, namely, KRAV certification and the Keyhole label, as well as the Sustainability Declaration of the Swedish retailer Coop.

6.1. Planet-score

In France, in 2021, the quest of enabling consumers to make informed choices and being able to compare food products inter and intra categories led to a creation of a food labelling. ITAB in collaboration with Sayari and Very Good Future, developed a sustainable food labelling called the "*Planet-score*" (ITAB et al., 2021).

6.1.1. Project holders

ITAB is an applicated research organism that is seeking at producing and spread knowledge in order to enhance organic production and transformation. It also focuses on fostering agroecological transition by facilitating agricultural and societal change towards diversified, sustainable and, resilient models. The three main missions of ITAB are: 1) applicated research on organic agriculture and food systems, 2) expert assessment to the public authority or companies and 3) knowledge sharing. Farmers (through CASDAR), the French Ministry of Agriculture, the French Ministry of ecological transition, Europe, and the French National research agency (ANR) are the main stakeholders supporting ITAB. This association was created in 1982 and encompasses today about 60 members (ITAB et al., 2021).

Sayari is a design office specialised in LCA, eco conception and biodiversity, especially on products derived from living organisms. This sustainability consulting works towards making operational last scientist knowledge in methods, data, and tools on the environmental assessment for companies and public institutions. Sayari is advising companies and participating in EC works on biodiversity, as part of the "*Business and Biodiversity*" initiative and scientific work in PEF.
In this regard, Sayari is a "*Technical Advisory Group*" member in PEF in EC. Sayari has coordinated the development of the Agribalyse 3.0 database, mandated by ADEME, for the 2500 French average products from farm to fork (ITAB et al., 2021; Sayari, 2022).

Very Good Future is a network of investors, business owners, researchers, experts, companies, partners, and students, identifying and catalysing sustainable agriculture and food projects. Very Good Future acts from the design of a project to the impact analyse, with an emphasis on behavioural science and consumer studies for the purpose of maximizing the outcomes of behavioural change (ITAB et al., 2021).

6.1.2. Presentation of the Planet-score

The Planet-score is a food labelling that is intended to alter consumer food purchases by providing more transparency on the environmental impacts and the method of production of the products. The first report describing this labelling was released in July 2021 and was calling the French and international scientific community for feedback and discussions to improve the labelling with a better depiction of the range of environmental issues (ITAB et al., 2021).
The Planet-score is built on the same basis as the Nutri-score, i.e., a scale grounded on five levels of colours (from green to red), and an alphabetical order from A to E. Based on the behavioural study published in July 2021, ITAB opted for a semi aggregated format that is framed with three visual parameters (Figure 5):

- The Scoring: An aggregated score summarizing the environmental impact of products
- The Graduation: Three sub-scores, namely, pesticides, biodiversity, and climate
- Method of production for animal products score: A colour-coded logo considering the animal welfare, until farm gate, for livestock products or items containing more than 5% of the mass recipe or represented in the commercial name (ITAB et al., 2021).

Figure 5: Planet-score labelling (Bonnot et al., 2022)

In March 2022, the labelling was rolled out in France and abroad (Germany, Spain, Brazil, and Canada). More than 80 companies are in the experimental phase, and, to this day, 3,200 food products have been appraised. It exists two possible depictions of this food labelling, either an on-pack or a digital version. Some brands such as Nat All or Le Labo Dumoulin have launched the on-pack printing of the food labelling (figure 6) and some retailers started to deploy it in their online shops (figure 7) (Bonnot et al., 2022).

Figure 6: On-pack Planet-score rolled out on Nat All and Labo Dumoulin products (Bonnot et al., 2022)

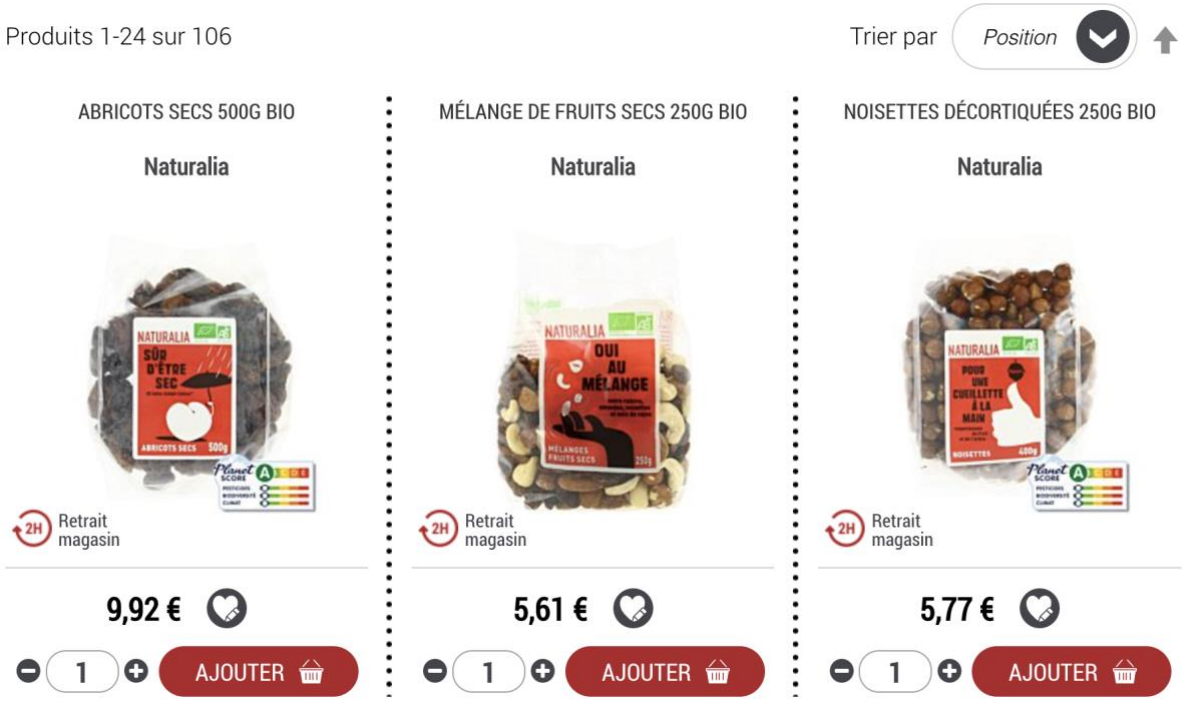

Figure 7: Digital version of the Planet-score from Naturalia's retailer (Naturalia, 2022)

The French Institute for Sustainable Development and International Relations (IDDRI) sheds light on three crucial aspects that sustainable labelling should translate: (1) a transition towards plant-based diets, (2) a food production system safeguarding the environment, and (3) integration of politic stakes such as social and nutrition issues (Brimont & Saujot, 2021).

In this light, Sabine Bonnot, from ITAB, claims four overarching stakes of the Planet-score:

- Reduction of the consumption of livestock products in a logic of "*less but better*", on account of problems linked to land use, animal welfare, and climate
- Imported deforestation, carbon storage, synthetic fertilizer
- Chemical pollution due to pesticides, plastics, antibiotics
- Loss of biodiversity (Bonnot et al., 2022).

The Planet-score provides a transversal vision by enabling the comparison of food items inter and intra categories of plant or livestock products, processed or unprocessed, while taking into account their labels. Qualitative and quantitative studies were conducted in France to shape the format of the labelling. Indeed, 58 interviews were carried out within two different shops, namely, Biocoop (organic retailer) and Lidl (conventional retailer) in urban, peri-urban, and rural areas for eight days for various categories of products, and with various formats of the labelling. In addition, a survey was disseminated to a sample of 1000 people, representing the French population aged 18 and over, indexed according to their gender, age (18-34, 35-49, 50 and over), socio-professional category (split in "*Csp+*"[8], "*Csp-*"[9], persons not in the labour force), and regions. The survey was circulated through the internet with a self-administered questionnaire that was composed of four sections: (1) Food habits, (2) Food consumption behaviours, (3) Score perception (aggregate / multidimensional formats), and (4) Future intention to adopt environmentally friendly eating habits (ITAB et al., 2021).

To finish, the Planet-score is the fruit of a collaborative work that tackled two aspects, (1) the consumer point of view, with a focus on behavioural science as well as with qualitative studies in shops and quantitative studies through surveys, and (2) a methodological perspective, with a work on the LCA deficiency aiming at providing solutions for improvements and the development of aggregation and calculation of a score (ITAB, 2022; ITAB et al., 2021).

[8] French term including company managers, shopkeepers and craftsmen, high intellectual professions, executives, and intermediate professions (Bathelot, 2020; Insee, 2022b, 2022a).
[9] French term including farmers, employees and service personnel, skilled or low-skilled workers, and labourers (Bathelot, 2020; Insee, 2022b, 2022a).

6.1.3. The functioning of the Planet-score

The final score is calculated on a scale from 0 to 100, by weighting the different sustainable factors, which is translated into an intuitively alphabetical score from A to E (ITAB et al., 2021). Table 2 exhibits the equivalence table.

Table 2: Equivalence table between score calculated and displayed, own table based on (ITAB et al., 2021)

Score obtained on a scale from 0 to 100	Planet-score displayed
80-100	A
60-80	B
40-60	C
20-40	D
0-20	E

The method is split into 4 sub-indicators where the total is equal to the final score. Each sub-indicator results in the combination of the semi-generic LCA of the product paired with a bonus/ penalty to address the lacking elements of the LCA method. (ITAB et al., 2021) has appraised that numerous parameters were neglected, why their method is proposing enhancement at different levels:

- Corrections carried out in the generic LCA base
- Consideration of some LCA specific data regarding the "*cradle to farm gate*" part (Climate, ammoniac, pesticides, land use)
- Logarithmic scale of sub-indicator LCA scores
- Bonus/ penalty in supplements applied to each sub-indicator (ITAB et al., 2021).

6.1.3.1. The global score

LCA method – AGRIBALYSE 3.0

The LCA method considered to build the Planet-score was based on the AGRIBALYSE 3.0 database (ITAB et al., 2021). AGRIBALYSE 3.0 is a database of life cycle inventories (LCI) of food consumption as well as agricultural products established by the French Agency for the Environment and Energy Management (ADEME) and the French National Research Institute for Agriculture, Food and the Environment (INRAE). The methodology followed is aligned with the main international guidelines in terms of LCA: ISO 14040, Livestock Environmental Assessment and Performance (LEAP) and PEF (Asselin-Balençon et al., 2020).

As part of the Planet-score, several indicators were added or rectified from the AGRIBALYSE 3.0 database since the database was judged incomplete and inappropriate by (ITAB et al., 2021). As a matter of fact, AGRIBALYSE 3.0 is following the recommended weighting set, and robustness factors of the PEF method while this last has been debated in the literature (Asselin-Balençon et al., 2020; ITAB et al., 2021; Pedersen & Remmen, 2022). As such, the EC admits that some impact assessment methods have become outdated (Galatola & Pant, 2014). (ITAB et al., 2021) are in line with this thought by claiming that, e.g, the nitrous oxide (N2O) emission factor, which is the highest factor of the climate indicator, is calculated in the PEF method, and therefore in AGRIBALYSE, based on the IPCC method 2006 (Asselin-Balençon et al., 2020; ITAB et al., 2021), while this has been rectified in the IPCC 2018 report (IPCC, 2018; ITAB et al., 2021). This leads to an exacerbation of the climate factor due to the robustness factor that reaches a final weight of 21% (ITAB et al., 2021; Sala, Cerutti, & Pant, 2018). Another example highlighting a limit of the PEF method is the omission of the ingestion of pesticide residues parameter which is asserted as being the overarching source in terms of human toxicity (Fantke & Jolliet, 2016; Gentil et al., 2020; ITAB et al., 2021). Consequently, this represents some of the reasons why (ITAB et al., 2021) have brought correction to the AGRIBALYSE 3.0 method (ITAB et al., 2021).

Figure 8 exhibits the global scheme with the four parameters to determine the global score, namely, human health, biodiversity, climate, and resources (ITAB et al., 2021). Apart from "*human toxicity, cancer effect; human toxicity, non-cancer effects; ecotoxicity freshwater; water*", each of the LCA indicators of the PEF method (Sala et al., 2018) has been integrated into one of the four parameters. Figure 8 demonstrates this repartition as well as the weighting between the parameters. The weighting used for the 16 categories is the one without the robustness factor (Appendix D) (ITAB et al., 2021).

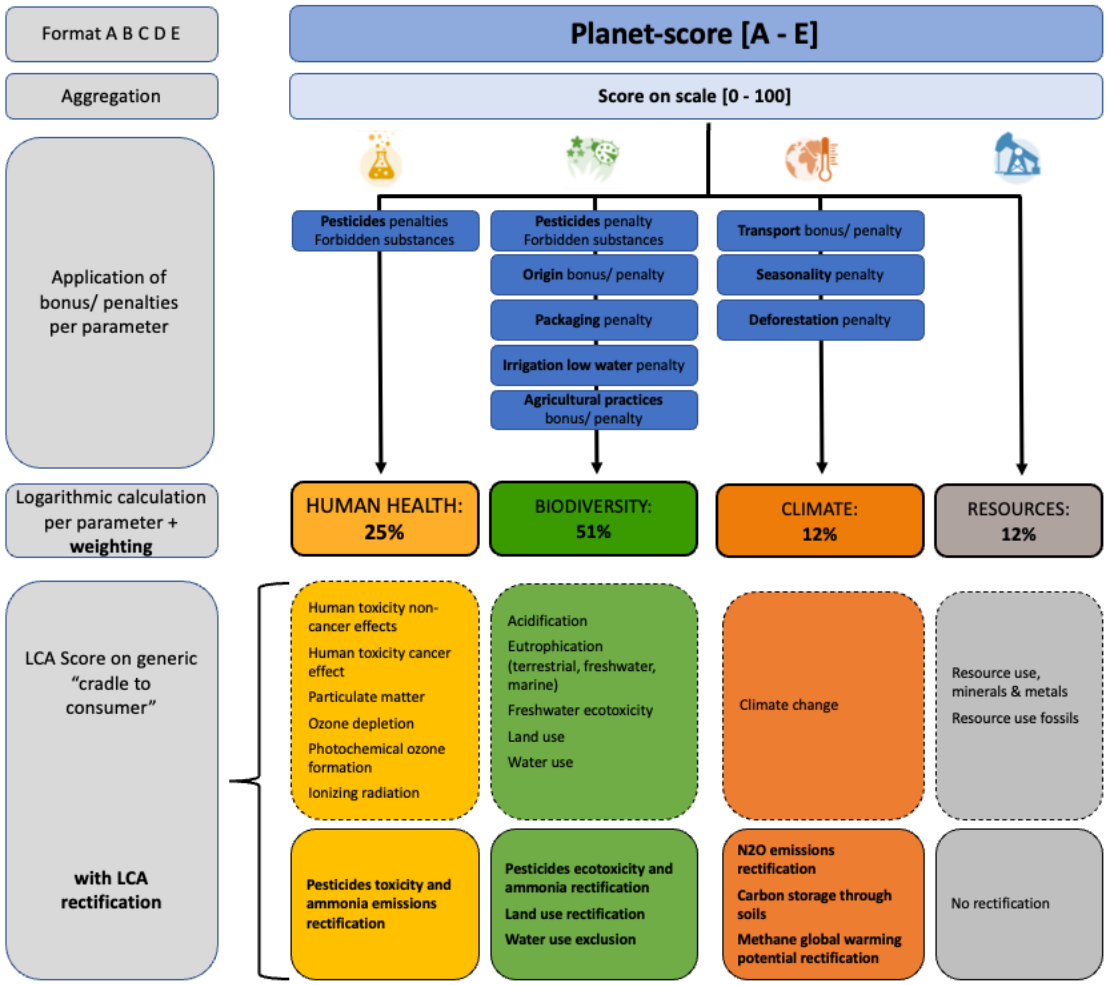

Figure 8: Global depiction of the calculation of the aggregated global score with the repartition of the LCA impact categories of the PEF method among the four parameters as well as the weighting of the parameters, own figure based on (ITAB et al., 2021)

Logarithmic calculation

A logarithmic distribution was established in order to ensure a distinction of products, with different methods according to the state of the product, solid or liquid. As such, the LCA score is then logarithmically transformed by following the same approach as Yuka[10]. However, the logarithmic transformation curves have been tailored in order to consider the repartition of the four parameters, and the point that the calculation is set by parameters instead of a global indicator (ITAB et al., 2021) (figure 9).

[10] Yuka is a mobile application that enables you to scan the bar code of food products and obtain clear information about the product's impact on health. https://yuka.io/en/

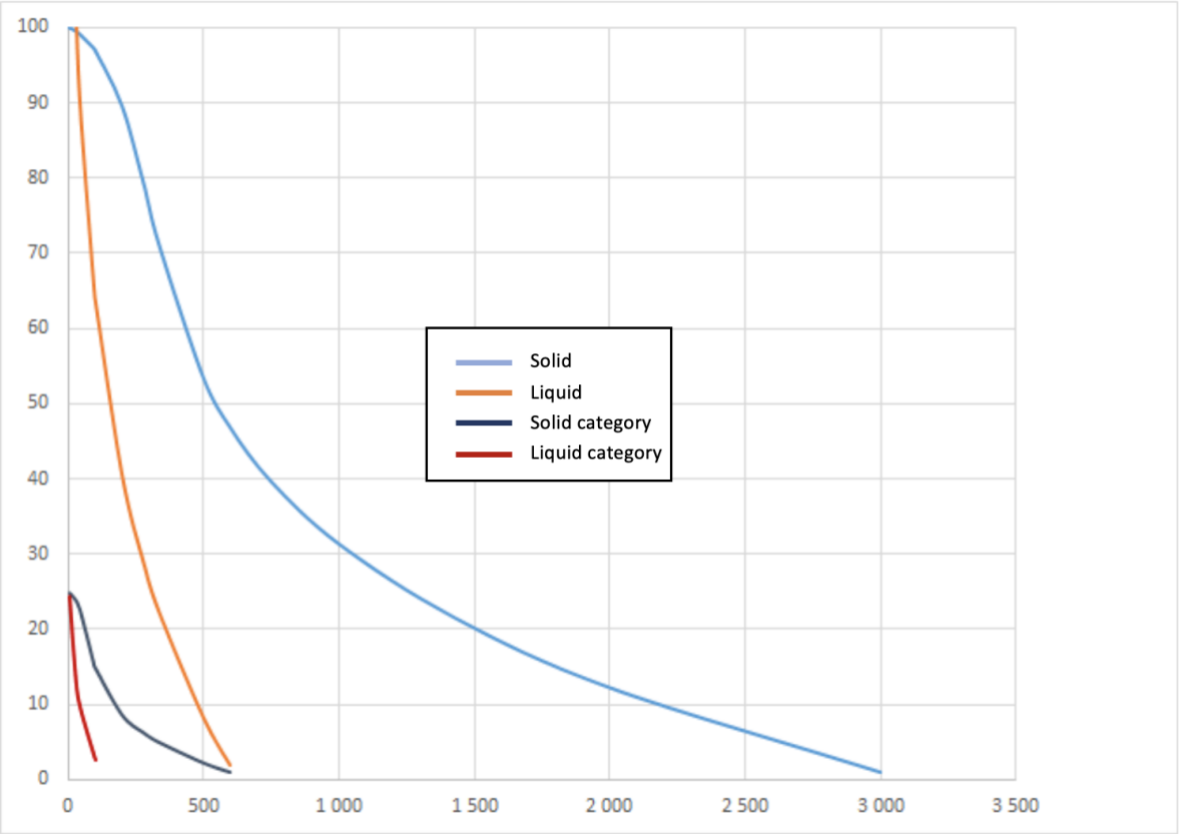

Figure 9: Logarithmic calculation of the Yuka Eco-score adjusted for the logarithmic calculation of each parameter based on the LCA score (ITAB et al., 2021)

Bonus/ Penalty per parameter

Human health

A pesticides penalty, varying from 0 to -25, is applied with the highest penalty corresponding to the use of two neonicotinoids previously forbidden in France and benefiting from a usage exemption. They are indexed as cancer toxicity, cocktail effects, and controversial substances (ITAB et al., 2021).

Penalty based on the effect of food additives, as well as antibiotics and anti-parasites used in breeding, might be further added (ITAB et al., 2021).

Biodiversity

A penalty linked to ecotoxicity (cocktail effect and controversial substances associated with pesticides) has been added. The highest penalty is -25 and is assigned on the same basis as for the health parameter (ITAB et al., 2021).

A bonus/ penalty, from -5 to 5, is also applied based on the origin (ITAB et al., 2021).

A bonus/ penalty, from -8 to 14, is applied according to the labelling of the products, enabling to distinguish the different practices (ITAB et al., 2021).

A penalty can be assigned for water use. It can reach -5 for crops that require irrigation in dry and low water periods and in water deficit areas (e.g soja, corn) (ITAB et al., 2021).

A penalty, based on the packaging can also be applied (in development) (ITAB et al., 2021).

Climate

A deforestation penalty, weighting -5, can be applied when products originate from deforestation such as Brazilian soja (ITAB et al., 2021).

There is also a transport patch and a seasonality penalty (e.g off-season crops under heated greenhouses) (ITAB et al., 2021).

Resources

This parameter has not been altered (ITAB et al., 2021).

6.1.3.2. Sub-score and aggregation

In the labelling, aiming at providing more transparency, supplementary information is provided for three distinct points that are dominant in the global score, namely pesticides score, biodiversity score, and climate score (ITAB et al., 2021).

The sub-score pesticide is including the toxic impacts of pesticides on human health with penalties and the LCA calculated data (environmental exposure and residues), as well as the ecotoxic impacts on ecosystems with penalties and LCA calculated data (terrestrial, freshwater, and marine ecotoxicity). Thereby, this sub-score gathers all human health and ecosystem impacts related to the use of pesticides to produce the food item assessed (ITAB et al., 2021).

The sub-score biodiversity is equal to the sub-indicator biodiversity with its bonus/ penalties and scaled from 0 to 100. The impacts of pesticides on ecosystems are also incorporated as without those, this sub-score is meaningless (ITAB et al., 2021).

The sub-score climate is equal to the sub-indicator climate with its bonus/ penalties and scaled from 0 to 100 (ITAB et al., 2021).

The method of production score is not integrated into the global score. In March 2022, (ITAB et al., 2021) were still working on this parameter (ITAB et al., 2021).

6.1.3.3. Sub-conclusion

Aiming at coming back to the planet's boundaries, the Planet-score sheds light on some sustainable parameters. It is asserted to be a pedagogic tool where the methodology is transparent, and thus, a trustable score by consumers based on the behavioural study carried out by (Bonnot et al., 2022; ITAB et al., 2021). (Bonnot et al., 2022; ITAB et al., 2021) claim that the Planet-score is a relevant instrument to help consumers make informed choices and through its calculation method, a genuine means of eco conception.

To conclude, based on the experimental results of (Muller & Ruffieux, 2020) and emphasized by ADEME, the labelling format is even more considered by consumers when it is:

- Aggregated - a format that offers a sole score or a score with a very limited number of indicators
- Prescriptive - it guides the choice of consumers through a colour-coded or alphabetical scheme
- Exhaustive - applied to all products (ADEME, 2021).

Thus, the Planet-score meets these criteria, and it is important to mention that in regard to exhaustiveness, the score is applicable to all products (ITAB et al., 2021). Nonetheless, the choice of the appending is managed by the public authorities, and to this day, it remains on a voluntary basis in France and in member countries of the EU (Bonnot et al., 2022).

6.2. KRAV certification

The Association for Control of Organic Production (KRAV) was developed in 1985 by a consortium of four organizations part of the Swedish organic movement as a non-profit-making association (translated as "*idéell förening*" in Swedish). Back then, the KRAV label (see figure 10) was one of the trailblazers in terms of eco-label and was managed by the Swedish Ecological Farmers movement. It was seeking to be a trustable label in regard to organic food, establishing rules for processing and organic production. On the international scale, KRAV was the first monitoring body, then, it was accredited by the International Federation of Organic Agriculture Movements (IFOAM). In order to reach a larger acceptance within the society, in 1990, KRAV became an incorporated economic association (in Swedish "*ekonomisk förening*"). From its beginning, KRAV was constructing an incremental closer link with state authorities to enhance its credibility. Nevertheless, the Swedish National Food Administration and the Swedish National Board of Agriculture only authorized KRAV in 1993. In 1995, when Sweden entered the EU, KRAV was permitted to certify organic production and agriculture as well as to monitor the accordance of the EU regulations regarding organic production. In 1995, KRAV was already more stringent than the EU regulation as it was already tackling a larger spectrum of parameters. In 2006, (Boström, 2006) claims that the awareness of the KRAV label was high among citizens, and people often related it with products which are healthy and safeguard the environment as well as animal welfare (Boström, 2006). In 2010, KRAV-labelling products was accounting for approximately 80% of all organic food products sold in Sweden (Pekala, 2019). The certification has recently known a decline as KRAV certification has covered gradually new matters that render the certification stricter than the EU organic green leaf certification (Boström, 2006; KRAV, 2022; Pekala, 2019). In 2022, it tackles health, animal welfare, social responsibility, as well as climate impact. KRAV is described as "*[…] Sweden's most well-known sustainability label for food and beverages, based on ecological principles […]*" by (KRAV, 2022, p.22) with 98% of consumers aware of the issue included in the label (Kiwa, 2022).

Figure 10: KRAV label (KRAV, 2022)

In order for food products to be certified by the KRAV certification, a company must provide some information to KRAV, have a KRAV number, and submit an application to an approved body certification such as Kiwa, SMAK, or Intertek to name a few. Thereafter, at least one audit per year is conducted by the certification body.

KRAV is working in collaboration with various stakeholders to formulate their standards such as producers, consumers, environmental organisations, researchers and businesses. KRAV is striving at enhancing its standards by releasing yearly changes. In 2022, KRAV certification is aligned with the EU regulation, and in certain aspects, is stricter and deals with larger areas, such as certification for fisheries and restaurants, or slaughter (KRAV, 2022).

To this day, 16 different types or categories of production are indexed by KRAV. The KRAV label is dominantly destined for food, nevertheless, some raw materials from organic agriculture can be accredited. The standards and inspection apply to "*production conditions, products and recipes, documentation, labelling, and sampling and analysis on a random basis.*" (KRAV, 2022, p.24). It concerns different steps of the food value chain: "*primary production, production aids and inputs, handling, storage and packaging, processing, sales and marketing, as well as products and raw materials certified according to other standards for organic production.*" (KRAV, 2022, p.24). To acquire the label, the entire production must be controlled and certified. Before any selling activity, a company must list each product on the KRAV website with information concerning the kind of production, food processing, production aids, feed production, bring in, and import (KRAV, 2022).

Social responsibility is one of the overarching pillars of the KRAV certification. Inspections of compliance with the Swedish legislation are carried out for KRAV-certified companies. Some requirements go beyond the Swedish legislation, such as the housing conditions for immigrant workers, careful control with seasonally employed staff, and extra requirements for bringing in and imports (KRAV, 2022).

Products cannot be marketed by the KRAV certification if it contains genetically modified organisms (GMOs), or items composed of or with GMOs. KRAV prohibits GMOs as it is complex to ascertain the risks and consequences of dispersion in nature. One of the purposes is also to prevent an agricultural system that relies on seeds and pesticides from multinational companies. Engineered nanomaterials are also forbidden as there is scarce knowledge regarding their effects on the environment, e.g the means by which they are absorbed by organisms or whether they bioaccumulate. Subsequently, although nanomaterials can infilter cell membranes and blood into the brain, studies demonstrating consequences on the human body remain uncertain (KRAV, 2022).

Packaging must have low climate impact and be resource-efficient. Substances that present negative impacts on human health and the environment must be avoided. Bisphenol-A is banned. When PVC-free choices do not present satisfactory food quality results, PVC in liners on metals and lid seals may be utilized. To help companies KRAV developed a "*Packaging Guide*" (KRAV, 2022).

Systematic environmental management must be performed and interest in cultural and natural environments must be demonstrated. Hazardous waste must be minimized, and all waste must be adequately sorted and taken for recycling or to landfill facilities (KRAV, 2022).

Companies are required to provide their energy efficiency measures. Through energy expertise, large companies are required to complete an energy audit. For energy-intensive greenhouses, a minimum of 80% of the energy must originate either from waste heat or renewable resources.

Permanently employed people must be prone to training in fuel-efficient driving. Electricity must be issued from renewable energy sources (KRAV, 2022).

In terms of crop production, growers that wish to transition their practices to be KRAV-certified are subject to a conversion period allowing time for the decrease of the effects of fertilisers and chemical pesticides in soils. The duration of this conversion period is measured on an equilibrium between facilitation to transition to organic production and consideration of consumers (KRAV, 2022).

Within the same agricultural company, it is prohibited to cultivate the same crop both industrially and organically as the risk of confusion is high. However, this does not encompass parallel production when differences are evident and various kind of the same crop is grown but a clear demarcation on the parcels is required. KRAV-certified food must also be grown 25 m away from roadways to avoid food contamination of lead additives and soil contamination of heavy metals. Nonetheless, animal feed is allowed to be grown in this area (KRAV, 2022).

New cultivation on humus soils is not allowed. Legumes must always be part of a crop rotation system and plant nutrients must be managed adequately. The addition of nitrogen through fertilisers is restricted to 170 kg per hectare. Conventional farmyard manure is allowed, however, more restrictions are progressively implemented to utilize manure that only comes from KRAV-certified production. The list of permitted organic and inorganic fertilizers is generally aligned with the EU regulation. The utilization of chemical pesticides composed of non-naturally occurring substances is not allowed. The KRAV plant protection products list is mostly in accordance with the EU regulation. Cleaning agents of facilities must be eco-labelled. KRAV certification has rules that apply to seeds and other plant reproductive materials. Some restrictions apply to greenhouse cultivation, as crops must be grown in soil and production in demarcated substrates is following the EU regulation (KRAV, 2022).

Regarding animal husbandry, behaviour, feeding and the environment in which animals are raised is a fundamental principle of the KRAV certification. It is not permitted to raise the same species of animals both industrially and organically. Breeding practices must comply with natural phenomena. It is required that animals receive access to the outdoors, especially in the grazing period. For housing conditions, stables must dedicate an adequate amount of space to allow the animals to move freely and all stables must be equipped with windows. The feed of animals must be of decent quality, adapted, and KRAV-certified. Farmers must aim at being self-sufficient in terms of feed and this requirement is stricter than the EU regulation. A minimum of three days is set for newborn calves, lambs and kids to suckle. With the exception of vaccination, preventive treatments and routinely substances fighting intestinal parasites are not allowed (KRAV, 2022).

In case of sickness and medication, a withdrawal period two times longer than the withdrawal period of industrial production must be respected. Animals in a slaughterhouse must all receive preventive, systematic work protection. The utilization of hard herding such as electric prods is forbidden (KRAV, 2022).

Aquaculture animals must be kept in decent conditions that are the closest to natural. Production must be in a safe area from effluent sources and distinctly isolated from industrial units. The use of hormones in order to stimulate spawning is forbidden. The use of synthetic/ non-naturally happening additives as feed is not permitted. Regarding slaughter methods, fish must be rendered unconscious (KRAV, 2022).

Concerning wild harvest production, plants must not be exposed to chemical pesticides or contaminants. Unlike the EU regulation, harvesting practices must deem local cultural traditions as well as the inhabitants of the area. To certify the production a risk analysis must be provided. Conversely to EU organic standards, all pickers must be able to understand the information through an appropriate language (KRAV, 2022).

Food processing is prone to some restrictions. A definite number of processes and process aids and additives are established. Natural flavourings must exclusively be utilized as well as some enzymes. In contrast to EU organic, nitrite is prohibited in meat products. To be KRAV-labelled a product must contain up to 10% EU organic items and a maximum of 5% of conventional ingredients. More than 90% of the ingredients of the products must be KRAV-certified to obtain the KRAV label (KRAV, 2022).

Production aids must not be harmful to the environment and some limits apply to the quantity of heavy metals soil and fertilizer may be composed of. It is not allowed to be constituted or produced from GMOs. Figure 11 exhibits the format of the label (KRAV, 2022).

Figure 11: KRAV label for production aids (KRAV, 2022)

For restaurants and caterers, KRAV has defined different levels (figure 12), with EU-certified organic and MSC-certified deemed sustainable:

- "*Basic: At least 10% KRAV-labelled food and in total at least 20% sustainable food.*
- *Bronze: At least 20% KRAV-labelled food and in total at least 30% sustainable food.*
- *Silver: At least 40% KRAV-labelled food and in total at least 60% sustainable food.*
- *Gold: At least 60% KRAV-labelled food and in total at least 90% sustainable food*." (KRAV, 2022, p.45).

The staff must be correctly informed about these criteria, and restaurants must state visibly the level to which they belong. Restaurants have also the possibility to mention on their menu the ingredients that are KRAV-labelled. Restaurants are required to perform an overall environmental performance (KRAV, 2022).

Figure 12: KRAV label for restaurants (KRAV, 2022)

In terms of fisheries, locations of fishing activities must be provided to consumers and fishes must be originated from sustainable stock as well as safeguarding ecosystems. KRAV has also requirements for the welfare of fishes, such as the duration for which they can be left on a hook. Northern Sea shrimp is the only fishing activity that, under specific circumstances, allows bottom trawling. Restrictions on the quantity of fuel used per kilo of landed fish are appliable (KRAV, 2022).

In an interview, conducted by *worldfavor* with Cecilia Lenbäck, manager for the food and beverage business area at KRAV, she asserts that KRAV emphasizes "*[…] how the food is produced and not where it is produced […]*" in order to foster sustainability in Sweden and globally (worldfavor, n.d.).

In Sweden, KRAV is in a close relationship with market players through direct dialogue. KRAV also concentrates on consumers' awareness through marketing and communication. When it comes to international work, KRAV collaborates with other certifications and works with regulations (worldfavor, n.d.).

To conclude, KRAV, as the most well-known Swedish sustainable food label, is addressing various parameters to promote healthy food without artificial chemical pesticides, a reduction of climate impact, animal welfare, biodiversity, and decent working conditions (KRAV, 2022).

6.3. Keyhole label

In the context of improving consumers' health and decreasing the risk of cardiovascular conditions, the "*Green Keyhole*" labelling was implemented by the Swedish National Food Administration in 1989 (Larsson, Lissner, & Wilhelmsen, 1999; Norden, 2010). As such, the identification of "*[…] fat-reduced and fibre-enriched food alternative products without having to read detailed nutritional labels.*" will be facilitated for consumers (Larsson et al., 1999, p.776; Livsmedelsverket, 2022). At that time, to obtain the Keyhole label, the specific food had to be a substitute for either high-fat or a low-fibre food product. It means that, for instance, fruits, vegetables, fish and meat that are naturally low in fat could not be Keyhole-labelled. The second criterion was that the food product presents a low-fat content or exceeds the minimum fibre content required. For example, to receive the Keyhole label, milk and yoghurt needed to have a maximum fat content of 0.5% and whole-grain bread a minimum fibre content of 7%. (Larsson et al., 1999) carried out a behavioural study with 746 men and 859 women aged 26-64 years old, and it turned out that 6 years after the implementation of the labelling, the majority of the respondents were understanding the meaning of the label. This study also highlighted that individuals with low education were to a lower extent likely to translate knowledge into practice (Larsson et al., 1999). The Keyhole is positive labelling that can either appear in green, black or white on the pack (figure 13) (Livsmedelsverket, 2022; Nordic Co-operation, 2021).

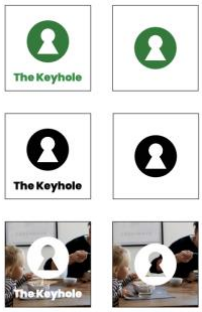

Figure 13: Keyhole label in black and green (Livsmedelsverket, 2022)

In 2022, the Keyhole concentrates on five areas: less salt, less sugar, more fibre, more whole grains and healthier fat. It is administrated by the Swedish Food Agency grounded on the latest research on Nordic dietary habits and healthy food. Nowadays, the criteria of the label are determined by joint discussions between Sweden, Norway, Denmark, and Iceland. The Keyhole was launched in Norway and Denmark in 2009, and in Iceland in 2013 (Livsmedelsverket, 2022). Today, 96% of Swedish recognize the Keyhole and studies have demonstrated that Swedish consumers appreciate that the Keyhole is monitored and accredited by an independent authority, the Swedish Food Agency. The fact that the label is utilized on food products in several markets in the Nordic region is perceived as an asset by Nordic consumers (Livsmedelsverket, 2022; The Swedish Food Agency, 2015).

There are no individual inspections for keyhole-labelled products. They are rather controlled within the structure for public food inspections. This label can be utilized for both packaged and unpackaged products. For unpackaged foods, it can be placed on baskets or boxes containing fruit, vegetables, or fish sold by weight, on a sign near the product, or on the shelf front. Food items are sorted into different product groups in order to have a common comparison basis (Livsmedelsverket, 2022). Today, the Keyhole is divided into 11 major groups and 32 subgroups:

- "*Vegetables, fruits, berries and nuts*
- *Flour, grains and rice*
- *Porridge, bread and pasta*
- *Milk, fermented products, plant-based alternatives, etc.*
- *Cheese and corresponding plant-based products*
- *Fats and oils*
- *Fish and shellfish and derivative products*
- *Meat, cold cuts, sausages, etc.*
- *Plant-based products*
- *Ready meals*
- *Dressings and sauces.*" (Livsmedelsverket, 2022, p.7; The Swedish Food Agency, 2021).

To obtain the Keyhole labelling, foodstuffs must not comprise sweeteners (food additives), approved novel foodstuffs with sweetening properties, and phytosterols, phytosterol esters, phytostanols and phytostanol esters. More information on the requirement of the label can be found in (The Swedish Food Agency, 2021).

To broaden the awareness of the labelling, an emphasis is placed on partnerships between the Agencies of the countries using the Keyhole with retailers, wholesalers, consumers, trade associations, local authorities and food professionals (Livsmedelsverket, 2022; Norden, 2010). To this day, the Keyhole remains displayed on products on a voluntary basis as agreed by the four countries (Helsedirektoratet, 2021). To render Keyhole-labelled products more appealing to consumers, new requirements are striving for more plant-based and vegetarian products (Nordic Co-operation, 2021).

To conclude, the Keyhole labelling is well-settled in the Nordic society and most of the consumers are aware of this labelling. It is a positive labelling that is covering nutritional values, namely, less salt, less sugar, more fibre, more whole grains and healthier fat. Products are classified into 11 main groups and 32 subgroups.

6.4. Coop's Sustainability declaration

In June 2021, Coop Sweden unveiled their sustainability declaration which was initially designed as a *"[…] purchasing tool to transition towards a more sustainable product range."* (Coop Sweden, 2021a, p.3). The purpose was to orient Coop's buyers during the selection process of suppliers and products. All products and ingredients are assigned a sustainability declaration in order to assess opportunities to replace ingredients to obtain a more sustainable product. It also became a means to inform consumers aiming at increasing sustainable consumption. Coop has the objective of developing a sustainability declaration on all of their food products, approximately 17,000 different items (Coop Sweden, 2021).

The sustainability declaration is grounded on the five largest ingredients that constitute more than 10% of the item. In this regard, in most cases, seasoning, salt, and additives are neglected. Instead of being appraised on their exact recipes, products are rated on the list of ingredients in descending order of information and size provided by the suppliers. The sustainability declaration results in a spider web scheme with a scale from 0 to 100, with 100 being the worst score (figure 14) (Coop Sweden, 2021).

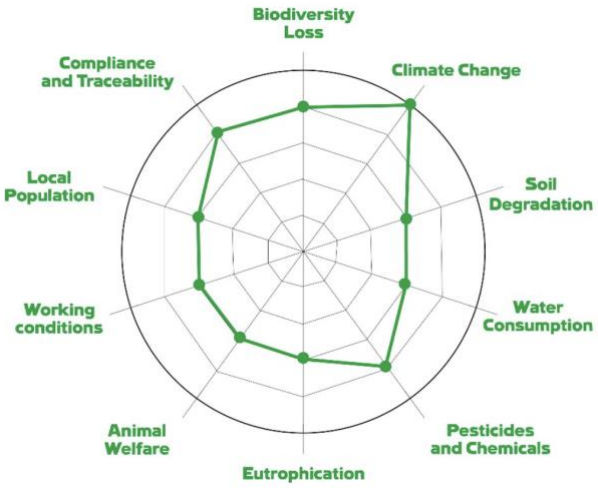

Figure 14: Example of the sustainability declaration with animal protein products (Coop Sweden, 2021b)

Ten parameters are assessed:

1) Biodiversity
2) Climate
3) Soil fertility
4) Water
5) Pesticides
6) Eutrophication
7) Animal welfare and antibiotics
8) Working conditions
9) Local population
10) Legal compliance and traceability (Coop Sweden, 2021)

Regarding the country of origin, raw materials are equally weighted in the algorithm. Fruit and vegetables are assigned a weighted value according to the proportion of the year in which various origins happen. If the origin is unknown, the product is not eligible for a sustainability declaration. For labels and standards already affixed on the products, the inclusion of the ten parameters is appraised as well as criteria that regulate the negative risk impact. Every six month, the availability of updated numbers from the data sources are checked (Coop Sweden, 2021).

The sustainability declaration of Coop is therefore a recent tool evaluating ten sustainable factors used in the selection of suppliers and products and to provide more information to consumers.

6.5. Sub-conclusion

The Planet-score is a new sustainable food labelling developed in France in 2021. The information provided through this score is threefold: (1) the main score is based on five levels of colours (from green to red), and an alphabetical order from A to E, (2) three sub-scores, namely pesticides, biodiversity, and climate, assessed with a colour-coded gauge, and (3) a colour-coded indicator for the method of production for animal products. The two first scores are calculated based on an LCA approach with the PEF method where some indicators have been corrected or added. To supplement this calculation a bonus/ penalty system has been incorporated. The animal welfare indicator is only incorporated when it is or contains animal products. In March 2022, this labelling has been released on some online shopping and some companies have started on-pack printing. To this day, the labelling is implemented on a voluntary basis. The parameters included are still subject to some improvements.

In Sweden, food labels and labelling are ubiquitous on food products. The KRAV certification and the Keyhole are two well-known food labels in Sweden. Indeed, KRAV is claimed by the KRAV organisation to be the most well-known sustainability label. The KRAV label is tackling sustainable parameters, namely, animal welfare, social responsibility, human health, climate impact and biodiversity. Moreover, according to the Swedish Food Agency, 96% of consumers recognize the Keyhole label. The Keyhole stands for nutritional factors as it addresses less salt, less sugar, more fibre, more whole grains and healthier fat. Both of them are positive labels that are displayed on a voluntary basis. The sustainability declaration of Coop is utilized both as a purchasing tool for Coop and as a communication instrument for consumers. Consumers have access to the assessment of ten parameters by scanning the bar code of the products. It is displayed in a spider web format and will be available for all Coop's products.

To finish, the Planet-score and the KRAV label are striving to influence consumers towards more sustainable and healthier diets, while the Keyhole is only focusing on nutritional factors and the sustainability declaration solely on sustainability. Ultimately, the two labels and two tools are, to some extent, contributing to the achievement of the targets 12.8 and 13.3 of the SDGs. As such, they are aiming at providing more information and transparency to educate consumers so that they have the ability to make informed choices. However, none of the existing labelling in Sweden is as exhaustive, transparent, informative, and intuitive as the Planet-score (see section 7.).

7. Analysis

7.1. How would Swedish consumers react to sustainable food labelling, such as the Planet-score, as part of the Farm to Fork Strategy?

This section analyses the outcomes of the survey. Firstly, the socio-demographic results of the survey are presented. Secondly, the potential practical application of the Planet-score in a Swedish context is described, emphasizing its perception and potential influence, level of confidence based on the actors who developed it, as well as a comparison with the Keyhole label, KRAV certification, and the Sustainability Declaration of Coop.

7.1.1. Socio-demographic analysis of the respondents

All respondents to the survey had to be Swedish citizens, otherwise, their answers were deleted since out of scope. In total, 52 respondents were Swedish citizens, and 75% of them were women, 21.2% were men, 1.9% were other, and 1.9% preferred not mentioning their gender. 53.8% were aged between 18-34, 30.8% between 35-49, and 15.4% over 50 (Appendix C). Figure 15 exhibits the socio-professional categories, the highest diploma level of education, and the residence places among respondents. The main socio-professional categories responding to the survey were students and intellectual and scientific professions. Most of the respondents had either a master's or equivalent level, or a bachelor's or equivalent level. More than half of the respondents were from West Sweden, and a quarter from Stockholm County (figure 15). Youth, including students, are more concerned about sustainability issues than other age groups (Minter, 2018). Recently graduated with a master's or equivalent, or a bachelor's or equivalent tend to be more sensitive to sustainable aspects as it is a topic that is gradually more tackled during education, especially in Sweden (Givetash & Banic, 2020). In that sense, answers may be steered towards improvements concerning sustainability due to these intrinsic characteristics of the respondents. In a representative survey, all gender, ages, socio-professional categories, diploma levels of education, and residences area would have been equally represented.

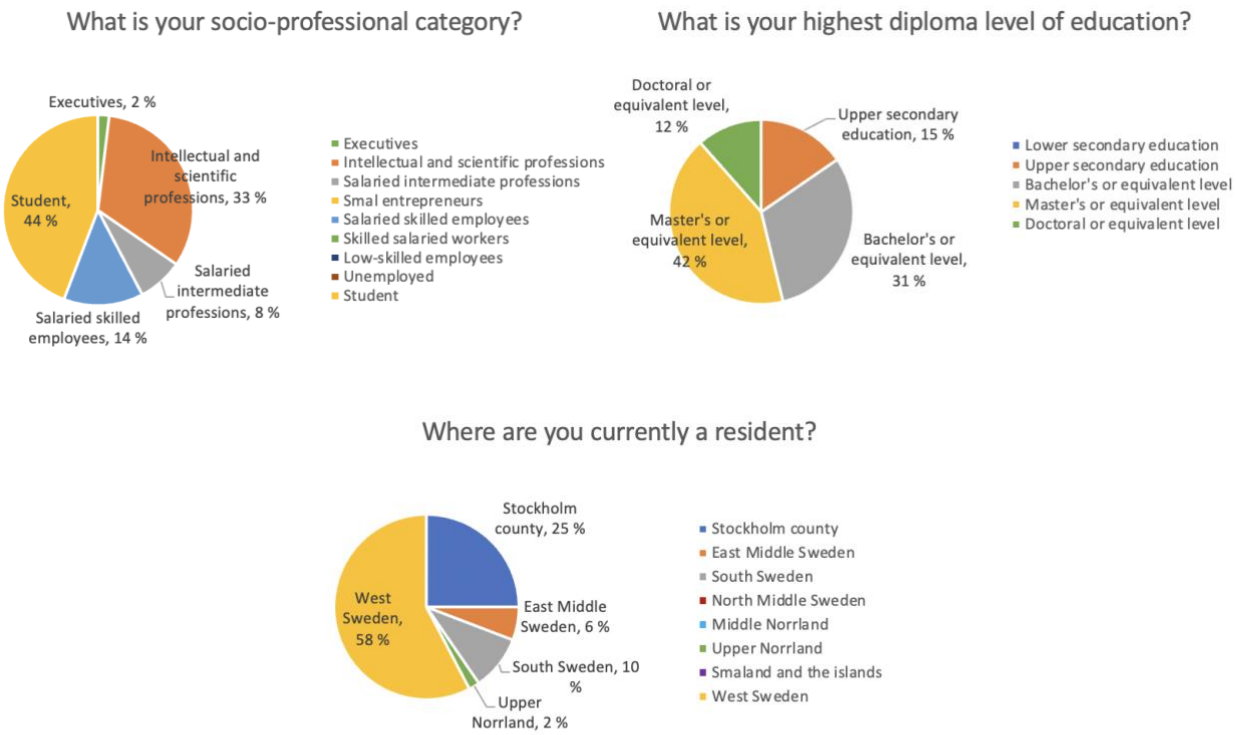

Figure 15: Socio-professional categories, highest diploma level of education, and residence places among respondents

7.1.2. The Planet-score in a Swedish context

7.1.2.1. Perception and potential influence of the Planet-score

Among respondents, the taste, the environmental impact, and the nutritional performance were the three most important criteria when purchasing a food product. Respondents were particularly interested in sustainable criteria. As such, 87% rated the environmental impact between 6 and 10, 82% rated the production method between 6 and 10, and 83% graded the working/ living conditions of producers between 6 and 10 (figure 16).

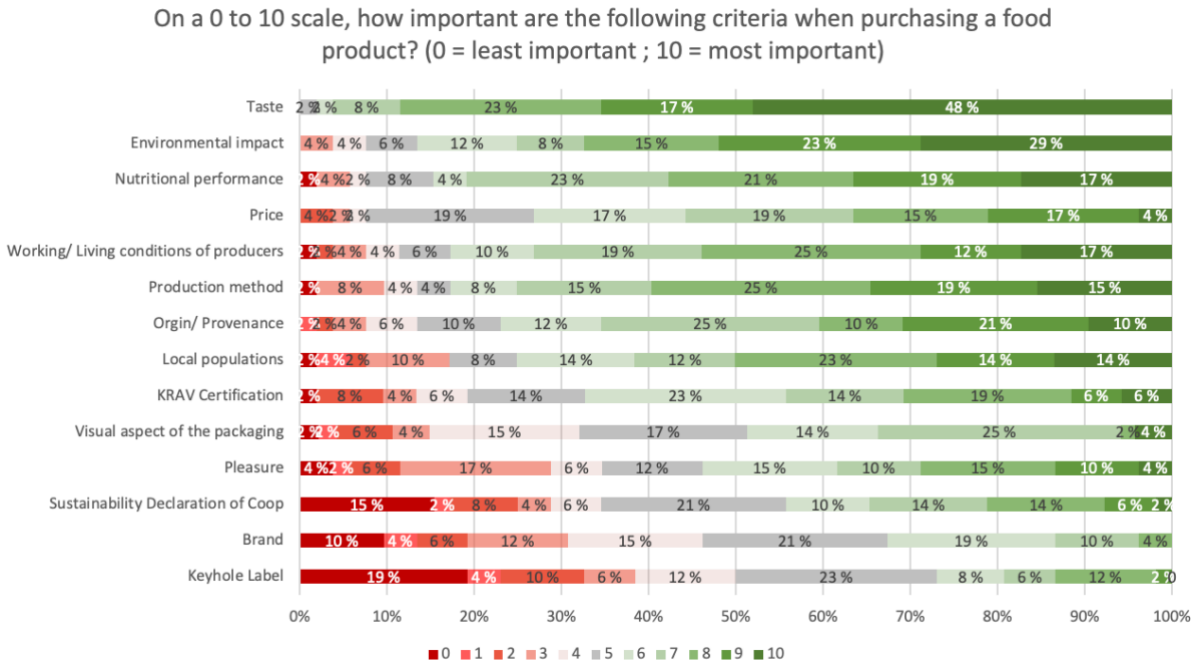

Figure 16: Criteria importance when purchasing a food product

Figure 16 demonstrates that, in terms of importance, 28% rated the Keyhole label between 6 and 10, 46% rated the Sustainability Declaration between 6 and 10, and 68% rated the KRAV certification between 6 and 10. Thereby, among respondents, those three types of labelling are not among the most important criteria to purchase food products. Here, there is a paradox as the KRAV and the Sustainability Declaration of Coop are touching upon sustainable issues of food, which are considered among the most important criteria such as environmental impact, or working/ living conditions of producers, but when translated into labelling, respondents are not considering them as significantly important in their food choices. This discrepancy is more accentuated with the Keyhole Label, standing for nutritional performances, which is the third most considered criteria, where 84% of respondents rated this criterion between 6 and 10, while the Keyhole label is the least criteria considered by respondents with 28% of respondents rated this criterion between 6 and 10. This type of incoherence may result from a non-appropriate communication of the information, and a lack of transparency, understanding or credibility.

When the Planet-score was introduced to respondents with a picture of it and describing it as labelling measuring environmental impacts, 77% answered between 6 and 10 that this labelling will help them decide on their food purchases. This demonstrates that the format and the information provided by the Planet-score seem to be appropriate to help the respondents with their food purchases. Notwithstanding, this does not necessarily mean that the Planet-score will impact consumers' food choices as there are other parameters such as taste, or price, that are playing a significant role in food purchases (figure 16).

Then, respondents were asked to assess the influence of the sub-indicators of the Planet-score (figure 17). 84% rated between 6 and 10 the Climate indicator, 80% rated between 6 and 10 the Biodiversity indicator, 75% rated between 6 and 10 the Pesticides indicator, and 74% rated between 6 and 10 the Production method indicator. Thus, most consumers are interested in the sub-indicators covered by the Planet-score and assert that it will have an influence on their purchases. Regarding the Climate indicator, 4% of the respondents answered 3 which was the lowest grade assigned to this indicator. This showcases an interest, although low, for all the respondents in the climate sub-indicator. 2% of the respondents answered 2 to the Biodiversity indicator, which was the lowest grade. This also shows that consumers are, despite to a low degree, influenced by the Biodiversity indicator. 4% of the respondents answered 0 to the Pesticides and Production method indicators meaning that only a small group of people would not be influenced by those indicators (figure 17).

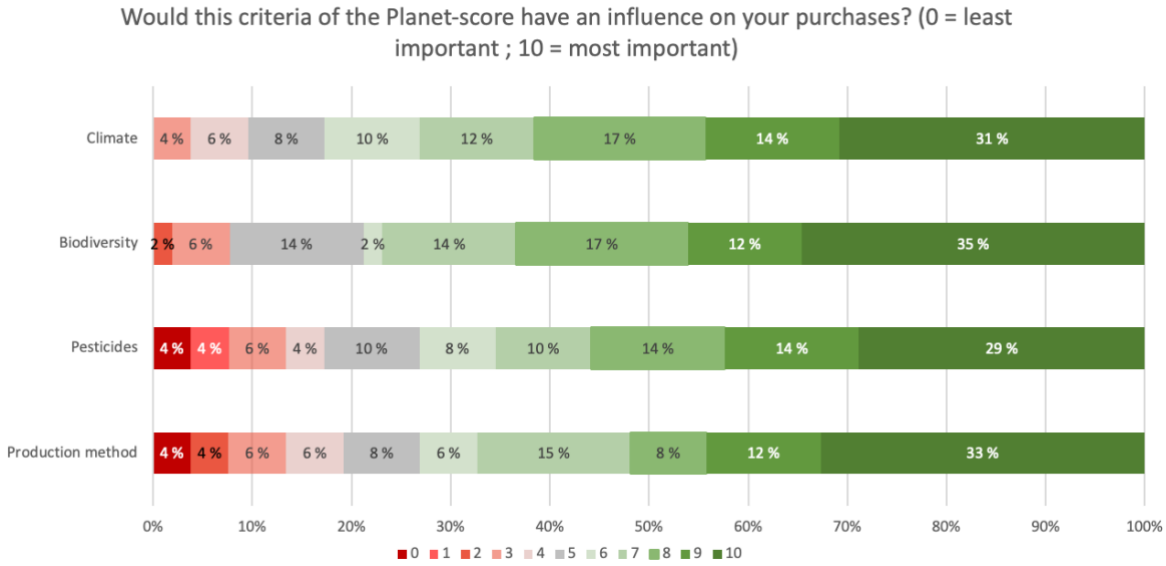

Figure 17: Influence of the sub-indicators of the Planet-score on food purchases

In order to understand the preference of respondents between an aggregated version or a semi-aggregated version of the Planet-score, the two versions were displayed, and they had to choose between both. 88.5% selected the semi-aggregated version (figure 18).

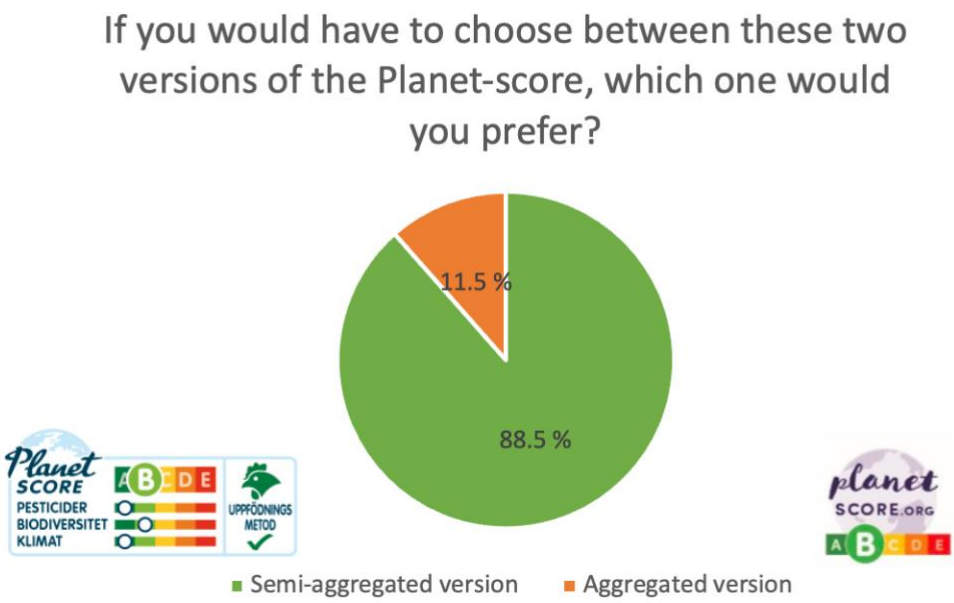

Figure 18: Consumers' preference between the semi-aggregated version and aggregated version of the Planet-score

In this light, consumers want to obtain "*more details and information*" on the food products and a simple letter does not provide information on the parameters assessed, "*option 2 gives me more specific details on how the final score got B*".

Among respondents, an attraction to transitioning and adopting more sustainable food consumption is observable, especially in the interest of giving preference to food that reduces the impact on the environment. Respondents would, to different degrees, primarily consider fresh and seasonal products, meats from environmentally friendly farms, and higher consumption of legumes, with 96%, 90%, and 88% of positive answers, respectively. Fishes from environmentally friendly farms would be the action the most considered with 71% of respondents answering "Yes, definitely" (figure 19).

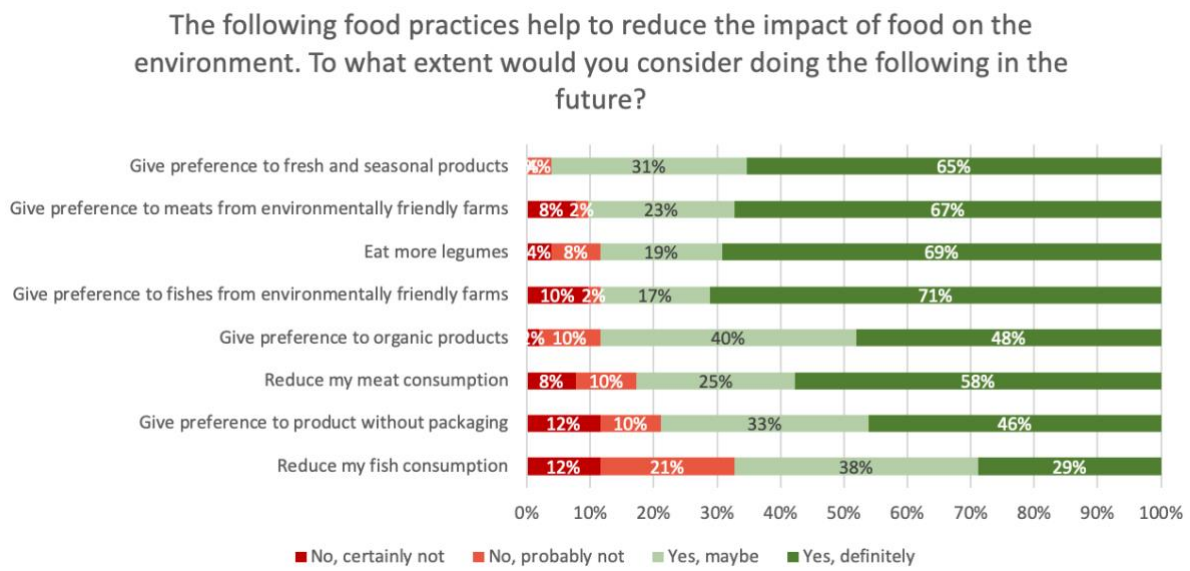

Figure 19: Food practices with low environmental impact considered by the respondents

The semi-aggregated version of the Planet-score could support consumers in this direction as these are parameters tackled. As such, the climate, biodiversity, and pesticides indicators stand for environmental aspects, and they are visible on the semi-aggregated version. Therefore, sub-indicators provide information to ease the selection between intra categories of food products towards more sustainable products. (ITAB et al., 2021).

Furthermore, consumers that are interested in environmental scores want to know more about the parameters assessed. As such, by only having an aggregated score, some consumers may not understand the meaning of it and may feel greenwashed.

"I decided for option 2 because of the specified parameters of sustainability, this would help as a consumer to see what is behind the sustainable-label and not just place it next to other already existing sustainable-labels" with "*option 2*" standing for the semi-aggregated version.

"*Everything is relative and there are so many different labels out there which sometimes feels mostly like greenwashing."*

The survey demonstrates that consumers expect to obtain information in a quick and easy manner. As such, 62% of the respondents assert that it would be "*very useful*" to have the Planet-score displayed on the packaging of food products, and 52% think that it would be "*very useful*" to have the labelling on the shelves in stores. While on a mobile application, only 11% think that it would be "*very useful*" and 25% think that it will be "*not at all useful*".

"*[…] I want to be able to see what products are better for the environment and for the animals by just looking at the placement or the label of the product."*

"Mobile applications are too time consuming."

"I would not take time to look for info (like searching in an app), I would like the get the info right away."

7.1.2.2. Trust in the Planet-score

To optimize the effectiveness of food labelling, the information provided needs to be trusted by consumers. Based on the survey, a consortium of scientists, the Swedish National Food Agency (Livsmedelsverket), and Environmental associations appear to be the most credible actors to develop a sustainable food labelling such as the Planet-score, with 93%, 87%, and 75% of the respondents who rated between 6 and 10 the trust in these actors, respectively. Inversely, 50% rated between 0 and 4 their confidence in Mobile applications, and 57% rated between 0 and 4 their confidence in Distributors/ Brands. Consequently, expert groups, institutions, and NGOs seem to be more credible to respondents than businesses (figure 20).

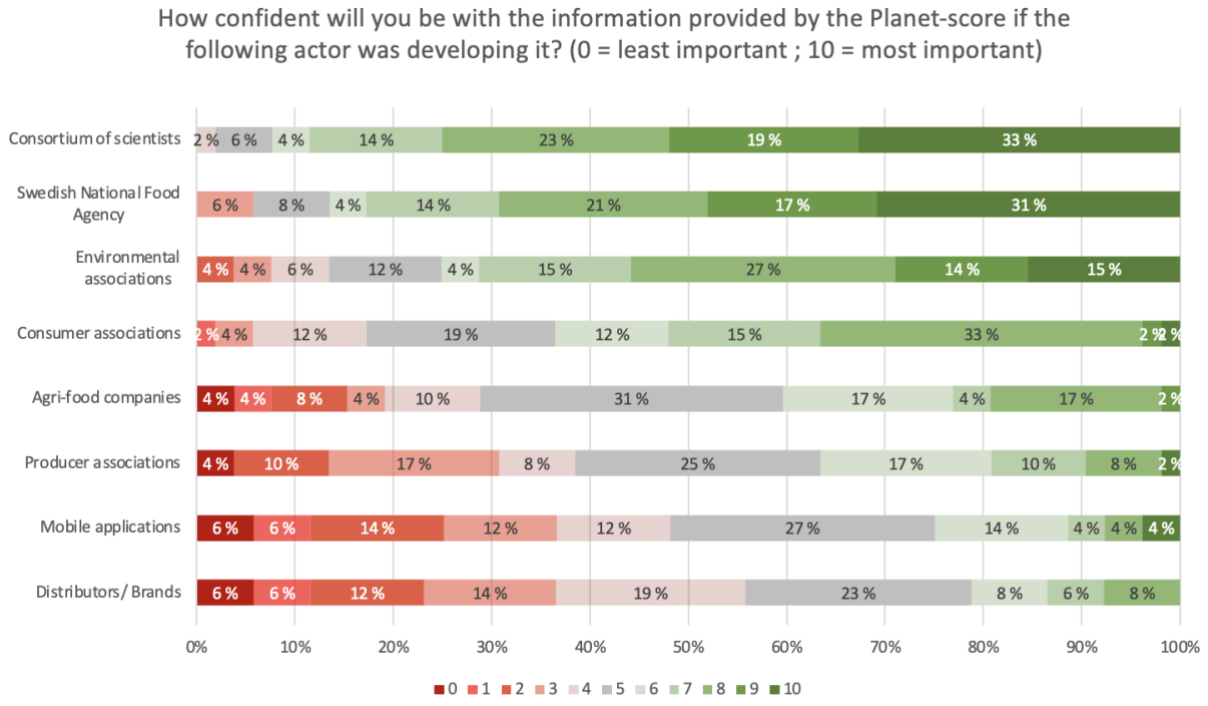

Figure 20: Confidence of consumers in the information according to the actors developing the labelling

Once consumers were told that the Planet-score was developed by mobilizing the expertise of environmental and agricultural scientists, several major consumers, and environmental and animal welfare associations, they had to evaluate their confidence with the information provided by the Planet-score on food products.

It turns out that 75% rated between 6 and 10 their trust in the Planet-score, with almost 30% assigning a confidence grade of 10 (figure 21). Thus, the actors who developed it seem to be a trustable combination by the respondents.

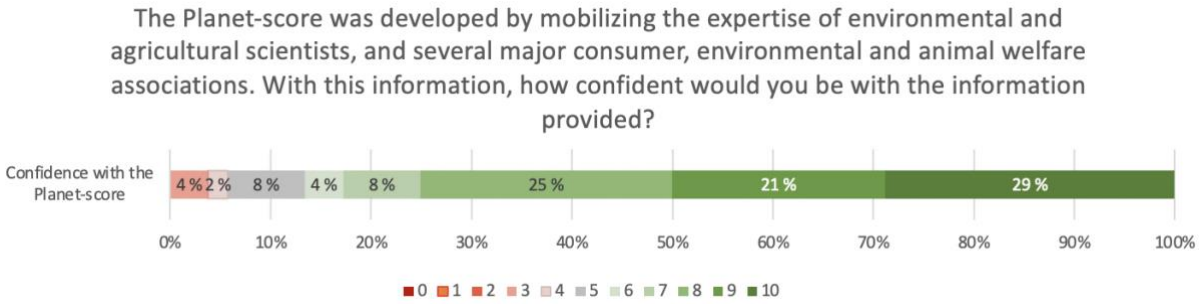

Figure 21: Confidence in the Planet-score based on the actors that developed it

7.1.2.3. Comparison of several food labelling

Once introduced to the Planet-score, consumers were shown four types of labelling, namely the Keyhole label, the KRAV certification, the Planet-score, and the Sustainability Declaration of Coop, and they were asked to pick the one that would help them to choose their products considering all labelling would be printed on the packaging. Results showcase that 44.2% would select the Planet-score, 28.8% for the Sustainability Declaration of Coop in Coop stores, 26.9% for the KRAV certification, and 0% for the Keyhole Label. 21 answers out of 52, respondents have asserted that the Planet-score provides "*more information*", is "*clear*" and "*easy*" to understand. This is also a common agreement as these reasons were mentioned by more than 90% of the respondents who chose the Planet-score (Appendix C). Nevertheless, in real conditions, the format of the Sustainability Declaration of Coop could also be challenging to append either on the packaging or shelves.

"*The planet score is detailed enough without being too confusing to customers. Also, might be easier to get a reasonable result in comparison to the detailed Coop one*."

"*This logo gives me more information than "the keyhole" and "krav", but less than the first one. But, for me, it's much easier to understand than the first one."* with the "*first one*" referring to the Sustainability Declaration of Coop.

"*I find the COOP Hållbarhetsdeklaration a tiny bit hard to interpret and if it were to be presented on products in a label format- the detail would be difficult to see given standard label sizes. More so I believe the Planet Score provides me with more thorough and differentiated information than the KRAV and 'nyckelmärkt' labels do."*

Hence, the spider web format appears less intuitive than the colour coded and alphabetical order of the Planet-score and requires more effort from the consumers.

7.1.3. Sub-conclusion

The survey performed in this study is not representative of the Swedish population since the gender, age, and socio-professional categories, as well as the level of education, and residential areas are not equally represented. Sustainable criteria are important in the food product selection among respondents, although some other parameters are highly considered such as taste, or nutritional performance. The survey exhibits that, if implemented, the Planet-score would be almost two times more considered than the KRAV certification, and the Sustainability Declaration of Coop. The Keyhole label would not be considered if these three labelling were also displayed on the packaging. From a consumer perspective, the choice of the sub-indicators of the Planet-score appears to be relevant and 88.5% would prefer the semi-aggregated version to the aggregated version, bringing evidence of an interest in obtaining more information from consumers. There is a willingness of considering adopting sustainable food consumption among respondents and the Planet-score is in adequation with consumers' expectations and criteria importance. Consumers are spending a short amount of time making a decision on their food products, thus, the information needs to be simple, and intuitive to be understood in a quick manner where the Planet-score seems to fulfil those criteria through its format compared to the KRAV certification, Keyhole label, and Sustainability Declaration of Coop. Displaying the labelling on the packaging of products or shelves would be more useful than having it on a mobile application. To be meaningful, the information must be trusted by consumers. Respondents would primarily trust a consortium of scientists, the Swedish National Food Agency, and Environmental associations. In that sense, a large majority of the sample would trust the Planet-score. To finish, the Planet-score would empower Swedish consumers by helping them to make more informed choices.

7.2. How would the format, the parameters, the feasibility and the developers of a sustainable food labelling, such as the Planet-score, be perceived in the Swedish governance?

This section elaborates on the format and the parameters that would be relevant in the conception of sustainable food labelling. This analysis builds upon the interviews carried out with Elinor Hallström, Martina, Görnebrand, Bettina Julin, and some supplementary inputs from Hélène Lepetit. Finally, a comparison between the Planet-score and the Keyhole label, KRAV certification, and the Sustainable Declaration of Coop is drawn up.

7.2.1. Format of the Planet-score

To begin, Hallström starts by mentioning the "*low understanding of different labels*" by consumers and the visual design plays a significant role in this regard. From a scientific perspective, she understands the selection of the four sub-indicators of the Planet-score and stresses that there are all "*relevant*" (Hallström, 2022, p.1-3). She stresses that the sub-indicators of the Planet-score improve its clearance and the transparency of it. In contrast to a binary scheme such as the Keyhole label or KRAV certification, the Planet-score does not necessarily require a "*background knowledge*" as through the sub-indicators, it is possible to understand what it stands for (Hallström, 2022, p.2)(The Swedish Food Agency, 2015). She continues by describing it as a "*well-defined label*" implying that the colour-coded and alphabetical design is relevant to facilitate the comprehension of the labelling. However, Julin does not necessarily approve this design as she mentions that having an alphabetical order and/ or a colour code is not allowing consumers to know the meaning of the score as it does not explain the criteria that drive the score, so the transparency problem persists (Julin, 2022 p.5). Görnebrand adds that providing more information with the sub-indicators will create a more difficult choice for consumers and relate it to nutrients by stating that the Swedish Food Agency has experience in it and "*know that it's a bit complex to people to understand*". In contrast, Lepetit claims that, although the health dimension is rather complicated to understand without any background knowledge, the sustainability dimension is totally different. It activates different levers and consumers can easily understand the matter and relate to the point, such as for climate or animal welfare. Lepetit also highlights that the audience stimulated is larger by having the sub-indicators. Depending on the consumer profiles, some might not be interested in a raw environmental score, while the exhibition of indicators they can refer to will appeal to them, as one respondent of the survey stated.

"I want to understand the score and the details more, and care more about some aspects and less about others."

The Planet-score is intended for everyone, but through its format, it is still targeting specific levers where some can be of a high importance degree for a particular type of population. For instance, people interested in health will be more prone to look at the pesticides indicator. Hence, Lepetit states that a semi-aggregated score is valuable for several consumer profiles (Lepetit, 2022, p.1). On the other hand, Görnebrand shows an interest in a "*summary*" by emphasizing that consumers spend a short amount of time in front of products, implying that although providing more detailed information, consumers would not spend time looking at it (Görnebrand, 2022, p.5). Nevertheless, according to the survey, consumers seem to be interested in obtaining more information:

"*Because it gives more details, appears more transparent. It allows me to make better informed decisions."*

"*It is easier to make a well-founded decision depending on personal values (what is worse: pesticides, biodiversity, climate...). In the first option, everything is condensed into a single measurement." with the first option the aggregated score.*

Hallström, from her "*subjective opinion*", is sceptical about the usefulness of having information on a mobile application, such as the one of Coop for the Sustainability Declaration "*Yeah, I wonder how many actually do scan them*." (Hallström, 2022, p.6). Görnebrand's opinion is also not in favour of mobile applications by outlining that most people are "*[…] lazy and don't look things up and don't use this kind of initiatives."*. Having the information on a mobile application will also render a more difficult direct comparison, as through the application, only one score at once could be looked at. Subsequently, she also points out that consumers' confidence is generally higher when the information is provided on the food than by having to scan something and be digitally redirected (Görnebrand, 2022, p.10). This point was also mentioned by one of the respondents:

"Everything in front of me is real, I can't get that assurance on a web page.".

Additionally, a study from Monash University states that consumers are spending between 3 and 5 seconds to decide whether or not they purchase a product in a retail environment, which is called the First Moment of Truth (Monash University, n.d.). Moreover, consumers are spending between 25 -100 milliseconds looking at labelling (Choices international foundation, 2019). This brings evidence to the fact that mobile applications are not likely to be visited so the information should rather be on the packaging or the shelves.

7.2.2. Sustainable dimensions included in a sustainable food labelling

To this day, the Planet-score is tackling the climate and environmental dimensions as well as the method of production for animal products. In that sense, some sustainability dimensions such as social and health are not considered (ITAB et al., 2021). Hallström states that these neglected ones are crucial dimensions of sustainability, thus, they need to be taken into account. However, Hallström raised her concern about aiming at gathering every sustainable dimension in a single score. From a consumer side, she points out that it would be very easy and quick as all information is condensed in the same place which is relevant as consumers make quick decisions on their food purchases. On the other hand, from a scientist's point of view, she highlights that having a separate score for all dimensions is "*more transparent*" and "*easier to work on the specific points*". Therefore, the separated score will also contribute to an improvement of the food value chain towards more sustainable food production. She ends by emphasizing that the Planet-score, with the sub-indicators, is a relevant alternative to counteract this issue. Notwithstanding, she is unsure of which indicators should be displayed on the labelling to keep a small labelling post (Hallström, 2022, p.4).

7.2.3. Comparison of several food labelling

Hallström and Görnebrand pinpoint that the Planet-score through its colour-coded, and alphabetical order is clearer than a binary scheme, such as the KRAV certification or the Keyhole label (Hallström, 2022, p.2; Görnebrand, 2022, p.4).

"I guess we've read some studies that colour codes are, scientifically, easier to be perceived by the consumers." (Görnebrand, 2022, p.4, Appendix E)

The Keyhole label and KRAV certification are positive logos, i.e., they cannot be appended on all products (Görnebrand, 2022, p.4). In this regard, the Planet-score would be easier for consumers to decide on their food purchases as it stands for all products (Hallström, 2022, p.2)(Muller & Ruffieux, 2020).

Although displaying many benefits, Hallström and Görnebrand agree that the Planet-score would not replace the Keyhole label and KRAV certification. As such, they mention that the Keyhole is covering the health dimension while this is not addressed in the Planet-score and the KRAV certification stands for organic products above all (Elinor, 2022, p.3; Görnebrand, 2022, p.6). Görnebrand points out that being mandatory at an EU level and covering the health aspect "*would probably make the keyhole to go away"* and the Swedish Food Agency is envisioning this in the future (Görnebrand, 2022, p.7).

Hallström would prefer the voluntary basis for the Planet-score right now, as she states that the data of the labelling should be of high quality, which is currently lacking according to her (Hallström, 2022, p.5). Julin highlights that "*it would not make sense to have it on a voluntary basis*" because companies would not display the score if their products were not sustainable (Julin, 2022, p.8). Nonetheless, in an internal meeting with Sabine Bonnot, ITAB's chairman, she mentions that the Planet-score could remain on a voluntary basis, and it will ineluctably warn consumers because the food producer is purposely not transparent.

Regarding the Sustainability Declaration of Coop, Hallström indicates that a trustable comparison could not be established if all retailers were to create their own Sustainability Declaration as Coop did. This implies that it will create confusion for consumers as different formats, algorithms, and results would appear (Hallström, 2022, p.7). This point is further elaborated in section 8.3.2.

7.2.4. Sub-conclusion

Points of view concerning the format of a sustainable food labelling are differing between Hallström and Görnebrand and Julin. Hallström is favourable to a colour-coded, alphabetical gradation, and the presence of sub-indicators while Görnebrand and Julin are more reluctant to this type of format. Hallström emphasises that this format would benefit consumers and companies, whereas Görnebrand and Julin assert that it would result in complexifying consumer purchases by providing more information. Nevertheless, they all agree that a food labelling needs to be displayed in stores either on shelves or packaging and not on mobile applications. Hallström stresses that some sustainable parameters would need to be included in the Planet-score to be more comprehensive with sustainability. However, she also mentions that it is crucial to have sub-indicators displaying various indicators to remain transparent. At the moment, a sustainable food labelling, such as the Planet-score, would supplement the Keyhole label and KRAV certification. In contrast to Julin, Hallström thinks that it would be relevant to have sustainable food labelling on a voluntary basis. Finally, Hallström advocates for a harmonized sustainable food labelling created by the same entity to draw consistent comparisons between food products.

7.3. Sub-conclusion

The survey carried out in this study does not represent the Swedish population as quotas were not applied according to the respondent's profile. The sample investigated is particularly considering sustainable criteria in their food purchases, although some other parameters are strongly important for the respondents such as the taste or nutritional performance. Among respondents, there is a dire need for obtaining more information on food products, shedding light on a semi-aggregated version of the Planet-score rather than the binary scheme of the Keyhole label, KRAV certification. Hallström supports this thought and asserts that the Planet-score is clear and easy to understand with the colour-coded and alphabetical gradation format. Nonetheless, Görnebrand and Julin are, to some extent, unsure that this format will help consumers in their food choices as they raise the issue of the choice complexity by providing multiple information. Through the sub-indicators, the Planet-score is reaching different consumer profiles as various activation levers are stimulated such as animal welfare, environment, and health. Consumers and interviewees agreed that sustainable food labelling should be displayed in stores, either on shelves or on the packaging. To maximise the effectiveness of sustainable food labelling, it must be trustable by consumers. Hallström emphasizes that sustainable food labelling should come from the same entity to be able to do a comparison between food products while not confusing consumers. Based on the survey, consumers place their trust in a consortium of scientists, the Swedish National Food Agency, and Environmental associations which are aligned with the actors who established the Planet-score. Currently, the Planet-score would not replace the Keyhole label and the KRAV certification. In opposite to Julin, Hallström believes that the Planet-score would be relevant on a voluntary basis.

The transition theory was useful to appraise the extent to which sustainable food labelling contributes to the transition of Swedish consumers towards more sustainable and healthier diets. Sustainable food labelling can, in that sense, empower consumers by providing more information to them on food products. On a broader scale, it can foster food systems to be more sustainable by spawning food producers and industries to enhance their practices. The nudge theory was relevant as food labelling is a nudge tool that provides information to consumers while conserving the freedom of choice. It turns out that sustainable food labelling can nudge consumers to adopt sustainable and healthy food consumption but presents some limitations (see section 8.2).

8. Discussion

This section discusses the potential consequences that sustainable food labelling may spawn on the food value chain. The limitations of food labelling are discussed with potential means to curb them. Finally, the ambitions of sustainable food labelling are discussed evincing the complexity of food choices.

8.1. Potential effects of sustainable labelling on the food value chain

Sustainable food labelling, in addition to being a potential tool contributing to orienting consumers towards more sustainable and healthier diets by translating science into a concise and simple scheme, may also play a role in B2B (business to business). As such, it can help to improve sustainability in the food value chain and in the production of food items by having sustainable objectives through the labelling (Lepetit, 2022, p.4; Hallström, 2022, p.1).Görnebrand takes as an example the Keyhole label and states that its criteria have pushed some companies to reformulate the recipe of some of their products in order to be Keyhole labelled. She also expresses that, during some interviews performed by the Swedish Food Agency, some producers acknowledged that they use their criteria as a benchmark to improve their products, although they are not able to obtain the label (Görnebrand, 2022, p.5, p.6).

Hallström stresses that the format of the Planet-score would be appreciated by many companies with whom she collaborated, as it offers more "*transparency*", as well as enable them to market and promote their improvements. In that sense, the gradation system and the sub-indicators generate enhancement points that are more visible than having an integrated score. On the one hand, it may be clearer for companies to know the underlying parameters where they need to work on. On the other hand, it emphasizes their efforts to consumers (Hallström, 2022, p.2). In this line, Hallström evokes that the sub-indicators may create a virtuous circle between consumers and industries, producers, or processors, because obtaining a higher overall score may require a lot of effort, and companies may, thus, be reluctant by looking at the costs and benefits. While improving a sub-indicator where companies know that it will appeal to consumers, may create greater motivation for them to do so. Therefore, sub-indicators may entice companies to improve the sustainability of their products (Lepetit, 2022, p.4).

Subsequently, companies may be motivated to valorise their actions which may spawn the booming of pedagogic initiatives to explain their actions to consumers and in turn, educate them (Lepetit, 2022, p.4). As such, in France, some companies requested to take part in seminars about the Planet-score to showcase their sustainability commitments and describe the measures that would be taken to improve the score of their products. In May 2022, some French companies already began displaying some signs to value their endeavours (figure 22).

Lepetit illustrates this thought by shedding light on the energy score on household equipment. Similar format of scoring was applied in this sector in Europe which improved the overall markets by creating a competitiveness effect. As such, if most companies are scoring A or B, companies scoring D or E are likely to see their sales decreasing, so it will foster them to follow the movement. This type of competitiveness effect may enhance sustainability of the food value chain which in turn may have knock-on effect on several sectors. For instance, aiming at the reduction of the use of pesticides will lead to an improvement of the water, air, soil quality which will benefit the biodiversity. As such, less chemicals will be released in the nature. Furthermore, human health may, to some extent, be improved as although, uncertain it is likely that ingesting chemicals may negative long-term health consequences. This may reduce some healthcare cost by decreasing a parameter that may be harmful for human health. Consequently, a sustainable food labelling may affect and improve the sustainability in various sectors and ineluctably contribute to the fulfilment of certain SDGs, such as SDG 3, 6, 12, 14, and 15, to name a few (Lepetit, 2022, p.3).

Figure 22: Sign promoting the Planet-score in a store in France, "It's local, it's organic, it's scoring A to Planet-score", figure taken from an internal document of ITAB

8.2. Limitations of food labelling

8.2.1. General limitations of food labelling

Sustainable food labelling may, to some extent, contribute to the transition towards sustainable and healthy diets, nevertheless, this nudging tool "*will not solve all problems"* (Görnebrand, 2022, p.2). In that sense, Hallström highlights that labelling "*could be an important tool to guide consumers*" and expresses a need for combining it with other initiatives (Hallström, 2022, p.1-2). Lepetit also shares this opinion by saying that "*labelling alone will not revolutionize diets, that's not true*" (Lepetit, 2022, p.5).

The fact that there is manifold labelling, can create a reluctance at looking at all of them. On the one hand, this can be explained by the time that is required to look at every single labelling while consumers want to have quick information (Appendix C). On the other hand, some labelling is not descriptive which creates difficulties to understand the purpose of the labelling. This may potentially stem from a lack of clearance or intuitiveness of the labelling (Hallström, 2022, p.1; Görnebrand, 2022, p.8). For instance, with a binary labelling scheme, such as the Keyhole label and the KRAV certification, it is difficult to understand their purposes by only looking at them (Hallström, 2022, p.2; Julin, 2022, p.4).

Food labelling only accounts for a food product scale (Julin, 2022, p.13). Aspects contributing to sustainable and healthy diets, especially for those from individuals, are thus, not included. For instance, eating a wide range of food is a cornerstone in human health, especially to cover all nutrients needs (FAO and WHO, 1996)(Julin, 2022, p.13), and labelling such as the Planet-score, cannot promote or rate this parameter. Other examples are, inter alia, the amount of food eaten (Hicklin, 2017), or the frequency and time of which the food is eaten (Aljuraiban et al., 2015), which cannot be monitored by a food labelling.

Hallström, and Louis-Georges Soler, Deputy Scientific Director for Food & Bioeconomy at INRAE (National French Institute of Agronomic and Environment Research), (panellist in a conference called “L’étiquetage simplifié des scores nutritionnels et environnementaux” (Simplified labelling of nutritional and environmental scores), state that today, to develop a sustainable food labelling, the access and the quality of data can be challenging (Hallström, 2022, p.3)(Académie d’agriculture de France, 2022). Hallström explains that some companies do not possess all data about their products, so drawing product-specific scores may be complicated. On the other hand, if a score is based on generic product data, the aim is lost (Hallström, 2022, p.5). In this line, Soler points out that building a score on generic product data will trigger a lack of comparison intra categories of food products which is not relevant from a consumer side. As such, it will create a standardization for each batch of food items which renders impossible the choice between several products within the same category. For instance, having a generic score for steaks is not accurate as various parameters can differ between two steaks, whether the animal was raised free-range, whether it is locally produced, or the type of feed used, to name a few. In that sense, a generic score would not enable the possibility to choose between two products of a same category and will not encourage to eat food of better quality. From a business perspective, companies’ actions to improve their products will also be invisible in the score. In this light, for example, there will be no difference in the score between carrots that are grown locally or imported, that are grown with different quantity of pesticides, or different agricultural practices, to state some parameters. Thus, it will not encourage food producers, processors, and distributors to improve the sustainability of their products as they will end up with the same score (Académie d’agriculture de France, 2022).

8.2.2. Limitations of the Planet-score

The Planet-score is a sustainable food labelling, however, some sustainable dimensions are not covered such as social, and human health. Additionally, some parameters included in the score are not fully addressed. For instance, the pesticide indicator is not tackling the cocktail effect of pesticides in food on human health, and the animal welfare is assessed only until the farm gate.

If the Planet-score were to include more dimensions as evoked in the Farm to Fork Strategy, "*[…] in synergy with other relevant initiatives, the nutritional, climate, environmental and social aspects of food products.*" (European Commission, 2020a, p.14), Hallström thinks that it is essential to keep the sub-indicators, and companies, with whom she collaborated, would also like more "*transparency*". Otherwise, with, for instance, a combination of all dimensions in a global score, consumers may be misled as some dimensions may balance others. (Hallström, 2022, p.4-5). Lepetit outlines that if the Planet-score were to cover more sustainable areas, it will be overarching to display sub-indicators touching upon each area. Otherwise, it would open gates for greenwashing and companies may only work on the easiest and heaviest indicators to increase the overall score. For instance, for some companies, it may be easier to improve the social aspect compared to the environmental aspect. Hence, they may only concentrate their efforts on the social dimension and vice versa. Additionally, if for example, the weight of the health dimension is heavier in the overall score, companies may take advantage of this weighting and only focus on this area at the detriment of others. By displaying, sub-indicators for each area and having an adequate weighting, it will influence and linearize companies' actions between sustainability dimensions. Furthermore, having only an overall score may conduct to a lack of credibility among consumers by offering less transparency on what the labelling accounts for (Lepetit, 2022, p.3). Hallström also raises the question regarding the size of the labelling as adding sub-indicators for missing areas to current ones may create a "*very large label post*" (Hallström, 2022, p.4).

8.3. Curbing the limitations of labelling

8.3.1. A combination of measures

First of all, all interviewees agreed that the roll-out of sustainable food labelling solely will not be an effective measure. Hence, they all stressed a need to accompany it with supplementary initiatives (Görnebrand, 2022, p.2; Hallström, 2022, p.2; & Lepetit, 2022, p.4).

"There is also a need for other types of information […]. So labeling is not a solution itself."
(Görnebrand, 2022, p.2, Appendix E).

In that sense, Hallström and WHO underline that other policy tools need to be coupled with sustainable food labelling to enhance the "*[…] information flow between research, stakeholders, and practices.*" (Hallström, 2022, p.2)(WHO, 2021a, p.6). Julin highlights that working with school meals, which the Swedish Food Agency do, is relevant as it is both reaching an important meal quantity as well as being a lever of change for future generation (Julin, 2022, p.12). Taxes can be an instrument to contribute to this transition of diets, e.g applying higher taxes on certain food products, and also managing the use of the money collected through taxes in a way that is improving human and planet health (Röös et al., 2021). Supporting the development of sustainable school meals could be a relevant means of money redistribution (Görnebrand, 2022, p.13).

Subsequently, Görnebrand points out that "*a lot of people only listen"* to professional staff such as teachers, medicines, nurses etc…, and are not considering other measures such as labelling (Görnebrand, 2022, p.13). On the other hand, Patricia Gurvez, Professor of marketing and consumer behaviour: UMR Food Process Engineering, Agroparistech, INRA, Université Paris-Saclay, explains that some individuals may not find it appropriate to ask medical doctors about the way of adopting more sustainable and healthier diets (Académie d'agriculture de France, 2022). This sheds light on different consumer profiles and the need to pair various initiatives to broaden the audience in order to orient the largest number of consumers towards sustainable and healthy diets.

Görnebrand pinpoints that campaigns may also be effective by using means of communication promotion such as advertisements in malls, on buses, or at bus stations (Görnebrand, 2022, p.13)(WHO, 2021a). Media could also be a pertinent instrument to convey information to people (Lepetit, 2022, p.5) (WHO, 2021a). Moreover, Lepetit evokes that, although having the information through labelling, some people may be reluctant from the outset to those options as they may think that "*it is not good*", "*it is more expensive*", and "*they do not know how to do*". As such, she emphasizes that distributors and retailers could implement sales demonstrations in stores on "*how to cook*", food stands to taste more sustainable and healthier recipes to advocate for alternatives, or again explaining that by reducing meat consumption at the benefit of pulses, it offsets the price increasing (Lepetit, 2022, p.5). As taste is the main criteria for respondents' food choices, degustation initiatives may be effective.

Görnebrand also raises the issue around the understanding of the meaning of labelling at the beginning of its implementation. Aiming at operating a fluid transition that is appealing to consumers, initiatives around the labelling should also be considered to, first, increase the conventionality of the labelling, but also to explain its purposes and how to use it. These types of measures may help to increase knowledge regarding the reasons why one food product is more sustainable and healthier than another and in turn, empower consumers. National dietary guidelines may contribute to this regard (Görnebrand, 2022, p.13)(WHO, 2021a).

However, measures supplement each other as dietary guidelines *"[…] don't tell you exactly if it's this carrot or another type of carrot is best […]"*, while sustainable food labelling would provide this information (Görnebrand, 2022, p.13).

As a result, Lepetit outlines that it is all communication efforts and nudges around food labelling that will maximize the potential effects of sustainable food labelling and lead to more sustainable and healthier diets. For instance, placing high score products at consumers' eyes could be an interesting nudge (Lepetit, 2022, p.4). It is also essential that manifold initiatives are implemented through a variety of stakeholders in order to widen the dissemination of the knowledge (WHO, 2021a) and in turn, the potential behavioural change (Lepetit, 2022, p.4). Lastly, Lepetit underscores the importance of the pedagogy side achieved by recreational activities and the valorising of the change to fluidify the transition (Lepetit, 2022, p.4). Gurvez agrees with this point, as she points out that consumers need a quid pro quo that motivates them for alternative solutions (Académie d'agriculture de France, 2022).

8.3.2. A need for a harmonized sustainable food labelling at the EU level

All interviewees agreed on the idea of standardizing and harmonizing sustainable food labelling (Hallström, 2022, p.6; Görnebrand, 2022, p.8; Julin, 2022, p.8; & Lepetit, 2022, p.5). Hallström indicates that, currently, it is "*a total chaos*", on account of the lack of comparison of results, stemming from the utilization of "*different style methods*" (Hallström, 2022, p.6). Görnebrand outlines that the Swedish Food Agency is involved in the EU work on the Farm to Fork Strategy towards the creation of a harmonized "*sustainable labelling framework*" at an EU scale. Lepetit stresses that harmonized sustainable food labelling would be feasible, from a consumer perspective, as some expectations such as pesticides are common in all countries (Lepetit, 2022, p.5). In that sense, the WHO emphasizes the current lack of "*consistency*" and "*comparability*" to appraise environmental and health indicators because of the non-existence of a "*standardized model for nutrition and sustainability*". Thus, the WHO advocates for common "*definitions, indicators, and guidelines*" (WHO, 2021a, p.6). (Röös et al., 2021) assert that harmonising "*health-related product labelling and developing a framework for sustainability labelling that includes health, climate, other environmental objectives and social aspects*", could be a cornerstone in arriving at a comprehensive sustainable food labelling (Röös et al., 2021, p.49).

Furthermore, concerning the Sustainability Declaration of Coop, Hallström agrees that if all retailers were to create their own Sustainability Declaration, a trustable comparison would not be possible between retailers (Hallström, 2022, p.6). As consumers are buying products in various store chains, it might create confusion among consumers as an identical product could obtain a different score depending on the methodology used (Görnebrand, 2022, p.11). Various visual formats could also be imagined which would also render the comparison more complex. In terms of effectiveness, the questionnaire demonstrated that distributors and brands would be the least trusted actors, and if the labelling were to be harmonized, it is likely to be achieved by a consortium of scientists, national agencies, and various associations. These actors appear to be the most trusted by consumers and it is those that created the Planet-score (figure 20). This collaboration work may then contribute to the accomplishment of SDG 17.

8.4. The complexity of food choices and their knock-on effects

Food choices are driven by a multitude of parameters that varies according to the consumer profile. Lepetit explains that in a behavioural study carried out in France about the Planet-score, they assessed two types of samples, one committed to sustainability and one representing the national population. It turned out that the sample engaged in sustainability was showcasing a larger interest in the Planet-score, and had higher expectations for detailed information (Lepetit, 2022, p.1). This brings evidence of how intrinsic individual parameters can influence the reaction and perception of a nudge initiative. Interests, values, gender, age, socio-professional categories, level of education, and residential areas are characteristics that may affect the influence of the potential effects of the implementation of sustainable food labelling (Lepetit, 2022, p.1-6).

Figure 23 exhibits the various layers of a food system grounded on a socio-ecological model. "*Diets*", being the last layer, is tremendously affected by drivers of the outer layers such as individual factors, food environments, sector of influence, socio-cultural and political environment, and ecosystems. Therefore, there are many parameters that play a role in choices, where some apply at the consumer level (e.g income, health, preferences) and others are more at a societal level (governance, culture, policies) or natural environment level (topography, climate, natural resources) (figure 23).

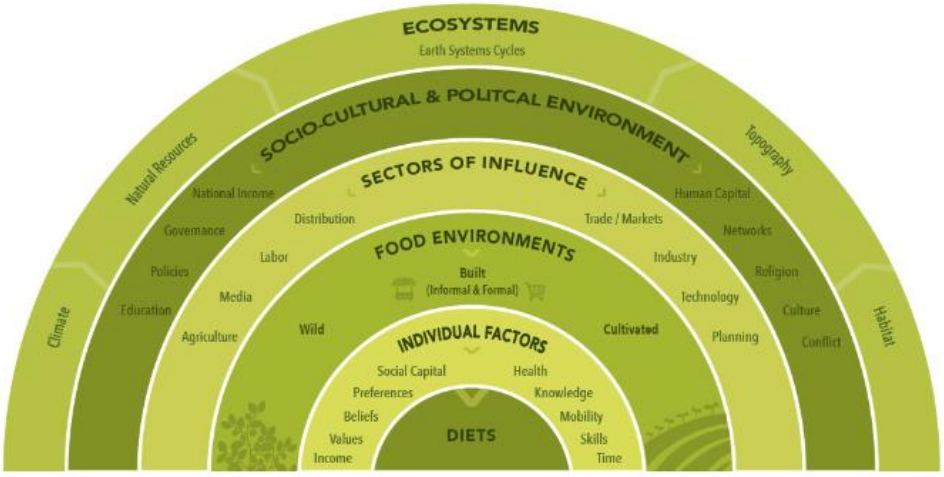

Figure 23: Layers of a food system built on a socio-ecological model (S. M. Downs, Ahmed, Fanzo, & Herforth, 2020)

Hence, from a consumer perspective, appending a sustainable food labelling on food items is an initiative that competes between various "*individual factors"*, which is why its potential effects can be limited. Sustainable food labelling may only stimulate a few factors, such as "*health*" and "*knowledge*", but many other factors remain. They may interact with each other and influence the final decision. Thus, this is the reason why sustainable food labelling may not necessarily have a strong impact on shifting diets towards more sustainable and healthier ones. This evidence the combination needs for various strategies at different levels promoting sustainable and healthy parameters to emphasize their benefits and to strengthen this transition. For example, campaigns towards sustainable and healthy diets may affect the "*skills"* and *"beliefs*" factors. Although the degree of importance between the factor may vary between individuals, working on several factors may, to some extent, contribute to a shift.

Furthermore, some sustainable factors may not directly impact the consumer at the time at which he buys or consumes the food products, evidencing why sustainable aspects may not drive some consumer choices. The idea of having a quid pro quo for consumers can enable gathering a larger audience, as stipulated by Gurvez (Académie d'agriculture de France, 2022). For instance, it may be relevant to highlight the health or financial benefits, through advertisements, or campaigns of moving from meat consumption to more plant-based diets, or consuming food with less pesticides. In that sense, consumers can easily relate and directly know the benefit they gain by choosing sustainable and health food products. The choice of sub-indicators can, to some extent, curb the differences between individuals' interests and knowledge by stimulating different levers and being thought-provoking (Lepetit, 2022, p.1).

Lastly, a change in diets may also nourish a transition in previous steps in the food value chain by creating new demand and market which may affect other sectors such as water, transport, or energy. As such, focusing on specific actions to meet SDGs 12 and 13 may also impact the achievement of other SDGs such as, among others, SDGs 6, 11, and 15, evincing the interconnectedness of the SDGs. To illustrate this thought, (Strid et al., 2021) emphasize that 55% of total agricultural income is issued from animal production, and consequently, a shift towards more plant-based diets, which will be the tendency of a sustainable food labelling, may affect the turnover of these business. As a result, those ripple effects also need to be considered and anticipated when implementing an initiative such as sustainable food labelling.

9. Recommendations and solutions

Based on the outcomes of the analysis and the discussion, the following recommendations have been appraised as relevant with the aim of promoting sustainable food systems. The focus was placed on sustainable and healthy food consumption through a nudge practice via sustainable food labelling. These recommendations are interconnected, thus, for larger effectiveness, all of them must be considered.

An intuitive, transparent, and concise format

Sustainable and healthy food labelling needs to be quickly understood. A semi-aggregated format with sub-indicators, colour codes, and alphabetical letters seems to be adequate to the respondents of the survey. Sub-indicators need to be congruent with consumers' expectations.

Set requirements thresholds for each criterion to increase from one grade to the next, where all of them need to be fulfilled to be able to level up the score. In this way, it avoids food producers/ industries to play with the score by only improving the easiest or the heaviest parameters.

Social, environmental, and health dimensions as well as animal welfare are crucial parameters. Nonetheless, sub-indicators must appear on the labelling to satisfy various consumer profiles and render visible efforts achieved by companies.

On packs or on shelves

Append the labelling either on packs or on shelves. Respondents of the survey wanted to have quick access to information and be able to perform an instantaneous comparison between products.

Actors without conflict of interests behind the labelling

Actors designing the labelling need to be neutral to provide high-quality information. This is very important for the credibility of the information provided to respondents. An interdisciplinary scheme constituted of a consortium of scientists, National Food Agencies, environmental, animal welfare and consumer associations seem to be the most relevant actors to draw up a sustainable food labelling for the respondents of the survey.

Combination of initiatives

Although activating many levers, sustainable and healthy food labelling on its own would not necessarily lead to a significant change towards sustainable food consumption and production. It needs to be aligned with complementary initiatives to raise awareness, such as advertisements, media, education e.g in schools and in shops, or through medical staff and health advisors to name a few possibilities.

European harmonization

There is a strong need for harmonization to avoid confusion, greenwashing and disinformation. A European framework must be established and standardized to have reliable data and be able to make a decent comparison between products and countries.

Voluntary basis

The labelling should preferably be established on a voluntary basis to preserve inclusiveness. Mandatory labelling may harm small producers as they may not be able to provide the data required. Inversely, companies that purposely do not provide the data, may indirectly create a warning signal for consumers if the labelling becomes widespread.

10. Reflection on methods and theories

10.1. Reflection on the questionnaire

Non-responses are strongly affecting the outcome of a questionnaire (van Loon, 2003). As such, non-respondents can bring different perspectives to the questionnaire which could influence the aggregated analysis. There is also a likeliness that a part of non-respondents is caused by a misunderstanding of some questions which results in abandonment of the questionnaire (Saunders et al., 2015). This argument may have had an even greater impact on this quantitative study due to the language barrier since the questionnaire was disseminated in English while not being the national language of Sweden. Despite this, efforts have been made to limit this inconvenience by providing a Swedish translated version of the Planet-score.

Participation bias may have further influenced the outcomes study as quotas have not been applied to the respondents. Thus, patterns among respondents may have been created (Saunders et al., 2015). As such, to avoid underrepresentation of certain groups, the utilization of quotas setting a maximum number of respondents based on socio-demographic parameters would have been relevant. A high rate of respondents is a crucial element to diminish the risk of participation bias which can jeopardize the findings (Groves & Peytcheva, 2008)(Internal meeting with Hélène Lepetit, 2022). Respondents' participation may have also been biased by the author's network and connections.

Moreover, as a non-Swedish speaker, some information may have been mistranslated and it may have limited my access to some documentation, especially about the KRAV certification, Keyhole label, and other studies on sustainable food labelling performed in Sweden.

In this study, some labels such as UTZ, FSC rainforest alliance, Fairtrade, Från Sverige etc... have been neglected and they could have altered the final results if they were included. Although the selection of the labelling was based on the most well-known labelling in Sweden, all of them are not accounting for the same purposes. Thus, it could have also been pertinent to appraise different types of sustainable labelling (Interview with Julin, 2022, p.4).

Moreover, a questionnaire is not fully represented real-life attitudes and behaviours as there are discrepancies between what people answer to the questionnaire and what they do in real life. Dishonest answers can be motivated for different reasons. Some respondents may wish to appear better than they are, some respondents may want to provide help to the author grounded on assumptions of researchers' needs, and some respondents may be interested in influencing the results to their benefit (Arthur, Hagen, & George, 2021; Infosurv, n.d.).

Although being supported by several persons, the initial interpretation of the answers to the open questions was strongly relying on the author's own understanding and perception. Open responses might have, thus, been analysed differently by someone else.

10.2. Reflection on theories

10.2.1. Transition theory

The purpose of the transition theory was to investigate the extent to which a marginal solution can gain interest and further develop. This theory was found congruent with the topic as harmonized sustainable food labelling, in a transparent format, is not developed in Sweden, and it may appear in the future through the Farm to Fork strategy. Hence, the use of the transition theory was motivated by ascertaining whether a sustainable food labelling, such as the Planet-score, could help transition Swedish consumers towards more sustainable and healthier food consumption.

This theory was useful to define critical parameters within a food labelling that may foster a shift towards more sustainable and healthier diets. In this light, the format of the labelling, the displaying choice, as well as the credibility and the transparency of the information were found to be essential aspects in order to optimize the effects that a sustainable food labelling might have both on the consumer side but also on the production side. On the other hand, this theory does not enable to appraise thoroughly the extent to which such an initiative will lead to more sustainable food consumption and production.

10.2.2. Nudge theory

In essence, this theory showcases how some alteration in the choice architecture can modify and incentivize predictable people's behaviour shifts while safeguarding the freedom of choices. The initiatives are, therefore, utilized to steer people's behaviour in predetermined directions.

The nudge theory was utilized to assess how a nudge initiative, namely sustainable food labelling, can nurture people to adopt more sustainable and healthier diets. This theory is complementary to the transition theory as the intrinsic criteria to draw up sustainable food labelling have significant effects on the effectiveness that this nudge practice may have. Nevertheless, it can be challenging to scale the potential effects that each criterion in the framework of sustainable food labelling may have as well as the overall outcome of the initiative. Quantitative and qualitative studies may help in this regard. However, representative sample methods are required. It is also worth enlightening that, although the focus of this thesis was on the consumer dimension, sustainable food labelling also nudges food producers in their food production practices.

11. Conclusions

Food labelling is a complex topic, involving many stakeholders throughout the food value chain. It may, to some extent, contribute to orienting food production and consumption towards more sustainable and healthier manners. A direct causal relationship between the development and the implementation of a sustainable food labelling cannot be drawn to the changes that may result since various external parameters are also playing a significant role.

In the quest of galvanizing Swedish consumers to adopt more sustainable and healthier diets with sustainable food labelling, five key elements have been identified through the questionnaire and interviews carried out in this study. This questionnaire was not representative of the Swedish population as quotas for respondents were not applied. The parameters included, the format, the way of displaying, the trust in the information, and the harmonization of the scheme are cornerstones to maximize the effectiveness of sustainable food labelling. Based on the interviews, environmental, social, animal welfare, and health dimensions should be covered to comprehensively tackle sustainability issues. The format needs to be transparent, intuitive, and clear, to quickly empower consumers. Businesses will also benefit from it in terms of marketing, as their improvements will be visible. A semi-aggregated score and an appropriate weighting are crucial to broaden the influence sphere and prevent distortion of information. Respondents of the survey are also appealed to obtaining more information and would be more influenced by a semi-aggregated format. Among respondents, the on-pack displaying is the means that may generate the most potential effects on their food choice as they expect to quickly obtain information. Cross-cutting approaches from several trustable actors would enhance the credibility of the labelling. A consortium of scientists, national agencies, and environmental associations are the most trusted actors by respondents. Interviewees emphasized that to avoid confusion, enhance consistency, and the quality of the data, the same scheme should be used at a European level. The Planet-score seems to be a relevant example of a sustainable food labelling that is appealing to respondents.

A sustainable food labelling would need to be paired with other initiatives to spur the transition towards more sustainable and healthier diets. Food labelling is assessing the parameters at a food product scale. Therefore, food labelling does not consider synergies between different food products and meals. Hence, sustainable food labelling may lead to shifts in diets, nevertheless, the alignment of this nudge tool with other incentives will foster a transition to a more global picture.

The combination of several strategies appears to be the optimal solution to improve the sustainability of food production and consumption and contribute to the achievement of SDGs 12 and 13.

12. Further Research

As part of this project, the emphasis was directed towards sustainable food labelling and particularly the Planet-score. However, currently, in this score, the health and social notions are not incorporated as uncertainties remain in terms of indicators and methods of scaling them. As such, more work in this regard needs to be completed, e.g on the cocktail effect of pesticide in food on human health, food processing, or working and living conditions of workers. Health and social dimensions may be areas that appeal to consumers, and depending on the consumer profiles, maybe more than the environmental aspect. As such, more consumer studies would be required to determine the most appropriate format to also communicate on the health and social areas. The weighting of the indicators would also need to be revised.

In the Planet-score, regarding the method of production for animal food products, it stops at the gate of the farm. Thereby, it will also be interesting to include parameters after this step as animals can be maltreated during the transport, and practices in the slaughter also need to be considered.

Blockchain, being a distributed ledger technology, could be an opportunity to improve the transparency and traceability of food products as it embraces a distributed, in contrast to a centralized, system. For instance, instead of having a system monitored by only one body, several actors, suppliers, and customers could receive access to the recordings of the supply chain (Mehmet, 2020).

This study focused on certain sustainable food labelling but some others are also existing such as the belong eco-score, the eco-impact, the eco-score, the impact score shopping, the Från Sverige, or the vegetable and meat guide from WWF to state a few. Therefore, it would have also been relevant to appraise the differences in the algorithm of these labelling and guides to compare their potential influence on consumer diets. A one-way multivariate analysis of variance (one-way MANOVA) method could be useful in this type of assessment (Folkvord, Bergmans, & Pabian, 2021; Statistics.Laerd, n.d.).

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