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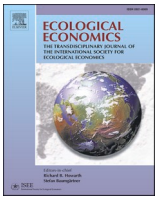

# Diagnostic, regenerative or fossil-free - exploring stakeholder perceptions of Swedish food system sustainability

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ABSTRACT

In an analysis of food system sustainability challenges and solutions among Swedish food system actors using Q-methodology, five perspectives were identified. One of the main three perspectives placed the highest priority on reduced meat consumption, food waste, and climate impact in agriculture, but downplayed strategies highlighted in the national food strategy and social aspects, and can be interpreted as a *diagnostic* climate mitigation-oriented perspective that does not reflect current negotiated policy processes or 'softer' values of food. In an alternative *regenerative* perspective, industrialized large-scale farming and lack of internalization of external costs were regarded as the main problems, and diversity, soil health, and organic farming as the main solutions. Proponents of a third perspective regarded phasing out fossil fuels, increased profitability of companies, increased meat production, and self-sufficiency as high priorities. These contrasting views can be a major barrier to transforming the Swedish food system. However, a number of entry points for change (*i.e.* aspects highly important for some and neutral for others) were identified, including focusing on healthy diets and increased production of fruit and vegetables. Focusing on these can build trust among stakeholders before moving to discussions about the larger and more sensitive systemic changes needed.

## 1. Introduction

Agriculture and food production is tightly linked to the United Nations Sustainable Development Goals (SDGs) and is at the core of Agenda 2030 (DeClerck et al., 2016; FAO, 2016; Wood et al., 2019). Developing sustainable food systems is therefore key to transforming societies towards sustainability (Hubeau et al., 2017). The current global food system poses considerable environmental and social problems (Hadjikakou, 2017) and many people lack access to healthy diets or suffer from obesity and diet-related diseases (Willett et al., 2019).

There is increasing awareness of the need for a food systems approach in research and policy (*e.g.*, HLPE, 2017; iPES Food., 2015). A food system can be defined as "*all the elements (environment, people, inputs, processes, infrastructures, institutions, etc.) and activities that relate to the production, processing, distribution, preparation and consumption of food, and the outcomes of these activities – namely nutrition and health status, socio-economic growth, and equity and environmental sustainability*" (HLPE, 2017). The HLPE food system framework differentiates between three key components: 1) food system drivers, *e.g.*, urbanization, technological change, and economic growth; 2) food system components, *e.g.*, food production, food value chains, and consumption; and 3) food system outcomes, *e.g.*, diets, environmental impacts, and equity. A food system operates at multiple scales within dynamic food environments and involves a multitude of actors (Ericksen, 2008).

The process of transitioning towards sustainable food systems is highly dependent on individual food system actors, whose actions and decisions are key enablers (or barriers) in system transformation (Dorninger et al., 2020; Leeuwis et al., 2021). Actions taken by individual food system actors in the interests of contributing to transformation towards sustainability depend on their perceptions of a sustainable food system, the main sustainability problem(s), and the most effective ways to accomplish change. In addition, achieving food system sustainability

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involves a number of inherent trade-offs, which means that negotiations between actors will be unavoidable (Brouwer et al., 2020). Therefore, identifying how different food system actors view food system sustainability and possible synergies and conflicts that exist between their proposed solutions and priorities for action is instrumental for discussing realistic pathways and solutions for a sustainable food system (Moreno-Miranda and Dries, 2022). Understanding food system sustainability narratives is particularly important, as these have a major influence on what is perceived and valued and the possibilities that are opened up, but narratives can also constrain imagination (Anderson and Rivera-Ferre, 2021).

The aims of this study were to evaluate how food system sustainability challenges and solutions are perceived by different food system actors and to identify differences and similarities in their differing interpretations. This was done by investigating how food system sustainability is described by Swedish food system actors, using Q-methodology (Coogan and Herrington, 2011; Lien et al., 2018; Sneegas et al., 2021). The results provided a much needed basis for discussing critical sustainability trade-offs and for identifying similarities between food system actors that can constitute a common ground for action.

## 2. Background

### 2.1. Food system sustainability framings

A sustainable food system has been defined as one *"that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised*" (FAO, 2018b). Although few would oppose this overarching definition, there are several diverging perspectives on what it means in terms of the problem description, proposed solutions, and suggested priorities.

A study by Béné et al. (2019) reviewed the literature to explore different interpretations of "sustainability of food systems", and identified four narratives. The overarching message in all these narratives was that 'our food system is failing us' but the perceived causes of the failure, and hence the proposed solutions, differed considerably between the narratives. Their first narrative, *not enough food*, focuses on the need to produce larger quantities of food to feed a growing, and increasingly affluent, global population. In the second narrative, *not enough nutritious food,* the focus is broadened to include the nutritional quality of the food, hence recognizing that there is enough food in terms of calories currently produced and that the problem is one of micronutrient deficiencies, poor diet quality, and overconsumption (Béné et al., 2019). In the third narrative, *too much inequality*, the emphasis is on inequity in food security (*i.e.*, hundreds of millions still suffering from hunger) and other food system inequalities (*e.g.*, control over inputs such as pesticides and seeds), the disconnect between producers and consumers, and the increasing market concentration, all developments that risk leaving the most vulnerable behind according to this narrative. The fourth narrative identified by Béné et al. (2019) centers on *environmental damage* caused by food systems, highlighting primarily the negative impact on biodiversity, climate, waters, and soil.

Another set of food system framings was offered by Garnett (2014), who suggested three emerging perspectives on sustainable food security. Her *efficiency perspective* is basically the same as the Béné et al. (2019) 'not enough food' narrative, and centers on the need to produce significantly more food world-wide for a growing and richer global population. This perspective takes the Western lifestyle as the 'good life' and assumes that it is possible to reduce environmental impacts sufficiently through increased efficiency of production. It also considers increased efficiency to be a means of 'saving' land by making cultivation more effective, which means that less land is needed for food production and more land can then be used *e.g.*, for nature conservation. The *demand restraint perspective* identified by Garnett (2014) highlights the role of the consumer in reducing the environmental impact of food. This perspective focuses on reducing consumption of resource-intensive foods, such as meat and dairy products, for the purpose of reducing greenhouse gas emissions and nutrient losses by reducing the number of animals. Here, too, there are opportunities to 'save' land, in this case by reducing feed production and cultivating more crops for human consumption. The *food system transformation perspective* considers imbalances and injustices in the food system to be at the heart of the problem. In this perspective, the challenge is not purely technical (more efficient production) and the solution is not purely at the individual level (restrained consumption). Instead, a major structural change to the food system is considered essential (Garnett, 2014). There are various views regarding what such a transformation might mean and what it might lead to, but it is common for advocates of this perspective to highlight alternative production approaches such as agroecology (Wezel et al., 2009), organic farming (Reganold and Wachter, 2016), permaculture (Ferguson and Lovell, 2014), and local and small-scale systems (Mount, 2012; Lamine, 2015). Regenerative agriculture, which focuses on soil health, is a recent addition to this flora and although not new, has recently received renewed attention from farmers, NGOs, and the food industry (Giller et al., 2021).

Suggested solutions for achieving a more environmentally sustainable food system can be categorized into three main groups: 1) supply-side improvements (increased energy, nutrient, water, and land efficiency and implementation of new technologies, *e.g.*, breeding, use of renewable energy, and improved management); 2) decreases in food system losses and waste; and 3) dietary change, above all reduced consumption of animal products (Bryngelsson et al., 2016; Röös et al., 2017; Bowles et al., 2019; García-Oliveira et al., 2020). Prioritizing between these categories will depend on the narrative and problem description, and the trust placed in either behavior change or technology (Garnett, 2015). A distinction also can be made between proponents (commonly industry, but also researchers) of new technologies such as GMO, precision agriculture, and cellular meat (WRI, 2019; Good Food Institute, 2022), and proponents of low-tech solutions, social innovations, and an increased role of governance (ipES Food, 2016).

In a recent review of the literature on food systems narratives and future scenarios, Anderson and Rivera-Ferre (2021) made a differentiation between extractive and regenerative systems. The *extractive food system* narrative aligns with neoliberal economic concepts, and emphasizes competition and the role of technology to solve food system challenges. Such agro-technical solutions (improved seeds, irrigation, mechanization, synthetic fertilizers, pesticides) have greatly increased food production in many regions but, due to lack of policy control, have led to power being increasingly concentrated to a few private actors (iPES Food, 2017). According to Anderson and Rivera-Ferre (2021), solutions based on this narrative fail to solve current food system challenges, as suggested solutions (*e.g.*, alternative proteins, big data, block chain technology) have questionable value for the poorest food producers and rather benefit global supply chains. In contrast to the productivist focus of the extractive narrative, *regenerative food systems* place greater emphasis on social and ecological interactions in the food system. Within this perspective, agroecology is cited as an example of a regenerative practice.

### 2.2. The Swedish food system

Forest is the dominant land use in Sweden and agricultural land (mainly arable land) occupies only about 8% of the total land area (SS, 2019). The main cultivated crops are cereals and grass-clover ley (39 and 43%, respectively, of arable land in 2021) (SBA, 2021b). The acreage of semi-natural pastures and meadows (currently occupying 1% of total land area), has decreased steadily during the past century, due to farmland abandonment in areas dominated by forest and intensified production in plains areas, which has led to severe losses of biodiversity (SEPA, 2020). Most farms in Sweden are small-scale mixed farms, but in recent decades there has been an increase in larger production units

specializing in either arable farming or livestock production. Arable, pig, and poultry farms are concentrated to the plains areas, mainly in southern Sweden, while cattle production is more common in the forest districts (SS, 2019).

Sweden relies on food imports, with the domestic market share currently supplying approximately 60% of domestic consumption of beef, 80% of pork and poultry, and only 20% of fruit and vegetables (SBA, 2021a). Over the past few decades, the domestic market share has decreased substantially for many products, and it has been difficult for the Swedish food industry to compete on the global market. However, Sweden's production of cereals (wheat, barley and oats) exceeds the domestic use, and the surplus is exported, while export of meat is only one fifth of imports (SBA, 2021c). In 2020, the value of food and drinks sold in Sweden amounted to 6% of GDP (SS, 2021a; SS, 2022).

In terms of sustainability, the Swedish food system performs well in several respects. For example, use of antibiotics in livestock production is among the lowest in the European Union (EMA, 2020), the introduction of advisory services targeted especially at reducing nitrogen losses in agriculture has been effective (Hellsten et al., 2017), and in terms of health and nutrition, the prevalence of undernourishment in the Swedish population is low (FAO, 2018a). Although farm workers have the lowest average monthly salaries in Sweden (SS, 2021b), compared with farm workers in many other parts of the world, Swedish farm workers are paid a decent salary and enjoy relatively good working conditions.

However, there are also many challenges with the Swedish food system. For example, the average Swedish diet heavily transgresses five out of six planetary boundaries (Moberg et al., 2020), and agriculture is a main driver of many environmental pressures contributing to the failure of Sweden to reach its environmental objectives (SBA, SEPA, SS, and SFA, 2012). Yearly *per capita* meat consumption expressed as carcass weight was 80 kg in 2021, which is lower than the EU average but considerably higher than the global average (SBA, 2022). In terms of nutrition and health, half the adult Swedish population is overweight or obese (PHA, 2021) and poor dietary patterns are the second largest behavioral risk factor for disease and premature death in Sweden, after tobacco use (IHME, 2019). Although there has been an increase in the intake of fruits and vegetables during the past decades (SBA, 2021d), only two out of ten adults consume the recommended amount of 500 g fruits and vegetables per day according to the latest dietary survey (SFA, 2012).

There are also challenges in the Swedish food value chain. For example, it suffers from low profitability, especially in the first components of the value chain, and a distortion in company size, where over 90% of companies in food processing and retail have fewer than 20 employees but the majority of turnover happens in large companies with 250+ employees. The Swedish food value chain also suffers from a low level of education and innovation capacity among key actors, which can impact willingness and ability to transition to a more sustainable food system (Swedish Food Arena, 2021).

### 2.3. The Swedish food policy

Sweden is a member of the European Union (EU), and as such part of the Common Agricultural Policy of the EU (EC, 2020a). In 2017, Sweden also launched its national food strategy, which was ratified by seven out of eight political parties in the parliament (GOS, 2017). It was developed with input from stakeholders throughout the food sector and relevant civil society organizations. The primary goals of the Swedish food strategy are increased competitiveness, self-sufficiency and employment aimed at guiding Swedish food systems developments until 2030 (GOS, 2017) but it also contains an ambition of striving for a more environmentally friendly food system. The Swedish food strategy is composed of an overarching bill containing the general goals until 2030, and a set of action plans issued by the government: the first one released in 2017, the second one in December 2019 (GOS, 2019). The plan includes *e.g.* targets for organic farming; 30% of the farmland area should be under organic management and 60% of food in public procurement should be organic by 2030. The EU level food strategy, the Farm to Fork Strategy (EC, 2020b), is considered to be in line with how Sweden wants to develop agriculture and the food system, *e.g.* by improving rural livelihoods and promoting knowledge transfer. The main difference between the two strategies is while the Farm to Fork Strategy can be regarded as a transition strategy, the Swedish food strategy is a strategy for growth in the agricultural and food sectors (SBA, 2020b). Sweden is a longstanding supporter of a market-oriented agricultural sector, and agricultural policies are shaped by this belief (OECD, 2018). For example, Sweden wants to interfere as little as possible with the market, opposing for example any possible "increased protectionism" (SBA, 2020b) derived from higher standards in the EU and spilling over to third countries.

## 3. Method and data

### 3.1. Q-methodology

Q-methodology offers an intuitive, yet structured, way of assessing stakeholder conceptualizations of complex phenomena (Coogan and Herrington, 2011; Lien et al., 2018). Using a combination of qualitative (textual analysis and interviews) and quantitative (factor analytical) approaches, Q-methodology examines stakeholder perceptions on how items that make up a complex phenomenon are related to each other (Brown., 1980; Watts and Stenner, 2012; McKeown and Thomas, 2013). The methodology has been used previously to study perspectives on ecosystem services (Hermelingmeier and Nicholas, 2017), environmental sustainability and resource efficiency (Curry et al., 2013), farmer typologies (Davies and Hodge, 2012), values and goals among progressive Brazilian beef farmers (Pereira et al., 2016), sustainability in Mediterranean olive production (Iofrida et al., 2018), and conservation research (Zabala et al., 2018), and recently to examine societal perspectives on food system transformation towards socioeconomic and ecological sustainability (*e.g.*, Piso et al., 2019; Belisle-Toler et al., 2021).

A study based on Q-methodology typically comprises four steps (see *e.g.*, McKeown and Thomas, 2013). The first step is to determine the Q-set, *i.e.*, the sample of statements that sufficiently represents the broader 'concourse', *i.e.* or all known perspectives on the issue of interest. A 'perspective' here is a matter of opinion, not necessarily a fact, and ideally captures the natural language in which the opinion was first expressed. The second step is to identify the respondents and invite them to complete a sorting exercise. Again, the goal is to achieve representativeness of all known positions to the greatest extent possible, so participants are purposively sampled rather than randomly selected. A Q-methodology study aims to cover a wide range of perspectives, rather than statistical generalization to the underlying population. In the third step, participants are asked to rank the statements in the Q-set, using a scale that typically runs from 'most disagree' to 'most agree', in relation to a guiding statement, or statement of instruction, provided by the researcher. In the sorting task, participants are asked to adhere to a forced normal distribution, meaning that they can only prioritize a very limited number of statements that they feel the most strongly about. As a result of the sorting task, each participant produces a Q-sort, *i.e.*, their distribution of statements. Principal component factor analysis is then used in the fourth step to identify different clusters of similarly arranged statements across Q-sorts, each of which represents a distinct perspective (Brown., 1980). In this way, each participant's subjectivity remains intact in the analysis, giving the researcher insights into what people think about a certain element of an issue, but also how individuals fit together and make sense of the many different facets of an issue.

### 3.2. Implementation of Q-methodology

#### 3.2.1. Identification of the concourse and Q-set

In identifying the concourse, we started from the framework used by Béné et al. (2019), which summarizes the perspectives on food system sustainability proposed by different communities of experts and practitioners (see section 2.1). Following that framework, we compiled the following elements for different food system actors:

- The main sustainability challenges identified (stated environmental, social, and economic sustainability problems)
- Themes considered to capture sustainability
- Entry-points for action (expressed solutions to overcome sustainability challenges).

Following Béné et al. (2019), we considered stakeholders to be grouped in five different 'communities of practice': agriculture (here interpreted as conventional agriculture); nutrition (here agencies working with public health); ecology (here represented by environmental NGOs); value chain (here divided into retailers and large and small processing industries); and agroecology (here divided into the more established organic production and the wider concept of agroecology). We then added the following four communities to reflect our specific case and increase the range of views represented in the concourse: tech companies working in the food sector; animal welfare organizations; consumers (represented by consumer organizations); and public authorities. Thus, stakeholders in this context refer to individuals involved in, knowledgeable of, or having relevant expertise or experience in a professional capacity (Cuppen et al., 2010). Consumers in the wider public were therefore not included in this study. We identified key stakeholders for each community, and then used websites, sustainability reports, and other material made available online by these key stakeholders to compile information on the three elements for all communities. Based on this material, we identified or formulated one or several statements that captured the essence of food system sustainability as expressed by that stakeholder, or their unique point of view. In total, we gathered a gross list of 117 statements through this process.

In two on-line workshops with stakeholders representing the different 'communities', we reviewed the statements to ensure that we had captured a multitude of perspectives, and to identify overlaps and unclear statements. Before the workshops, the 117 statements were sent out to the participants and they were encouraged to check these for clarity and relevance, and to add additional statements. An additional 21 statements came in from the participants before the workshop and one was formulated by the authors from the workshop notes. The workshop participants were also encouraged to select 30 statements that they believed best captured their view of food system sustainability (according to the prompt in section 3.2.2). In total, 32 stakeholders, representing all communities of practice, participated in the workshops.

To reduce the total concourse into a Q-set, *i.e.*, a manageable subset of statements to use in the sorting exercise, we first categorized all statements into one of the following four categories: problem description (*i.e.*, expressions of causes of the current malfunctioning of food systems); solution (*i.e.*, proposed ways to increase the sustainability of food systems); change agents (*i.e.*, actors who could influence change); and sustainability aspects (*i.e.*, certain themes of sustainability, *e.g.*, climate impact or animal welfare). We then further categorized the solution statements into whether they represented: a 'mainstream view' (*i.e.*, solutions in line with current developments and trends and not questioning the basic functioning of the current food system); an alternative view based on strong trust in high-tech solutions; or an alternative view based on strong trust in nature-based solutions. One of the authors then made a first selection of 55 statements based on the 30 statements selected by the stakeholders before the workshops and on discussions during workshops, while aiming to include statements about problems, solutions (from all three views, *i.e.*, mainstream, alternative technology, and alternative nature), change agents, and sustainability aspects. In an iterative process performed by three of the co-authors, this selection was further refined and some of the statements were adjusted for clarity. Finally, 55 statements were selected and verified by all co-authors.

#### 3.2.2. Identification of respondents

For each community of practice, we selected several stakeholders to take part in the sorting exercise. We deliberately avoided any individual who had attended the previous workshops (section 3.2.1), in order to minimize bias and influence from previous discussions on the statements. The selected participants can be regarded as a convenience sample, *e.g.*, we sent out invitations to organizations representing different communities of practice and asked for volunteers. However, we accounted for diversity in gender and age when putting the sample together. A list of 106 people was compiled.

#### 3.2.3. Data collection

Data were collected using the Qsortware software (www.qsortware.net) online tool, which facilitates data collection in an intuitive two-stage process, following the Q-methodology. First, statements were sorted into three categories; 'Does not agree with how I think', 'Neutral' and 'Agrees with how I think'. In the second stage, the division of statements was further refined into 11 groups that replicated a normal distribution of the respondents' sorting of statements (Fig. 1). The sorting grid design allows for only a few statements at the extreme ends of the scale, and thus the majority of the statements cluster in the middle. Participants were asked to rank statements based on the following prompt: *Please evaluate the statements in relation to the sustainability challenges you think the Swedish food system is facing and/or what strategies you think are important to move the Swedish food system in a more sustainable direction*.

Invitations were sent *via* email, together with a short introduction to the study. Two reminders were sent, one to all invited participants and one targeting those communities of practice for which we lacked answers. Representatives from all communities of practice except nutrition (actors representing nutrition are likely to have registered as public authorities) answered the survey. A total of 36 Q-sorts were collected and analyzed, which is well in line with the total in previous Q-methodology studies (Sneegas et al., 2021).

#### 3.2.4. Statistical analysis

In line with previous studies using Q-methodology (*e.g.*, Pereira et al., 2016; Hermelingmeier and Nicholas, 2017), we analyzed the Q-sorts statistically using principal component factor analysis (PCA). The aim was to summarize the Q-sorts into a smaller set of factors that could be taken to represent the dominant perspectives on food system sustainability challenges and solutions as represented by different actors in the Swedish food system. We used the qfactor command (Akhtar-Danesh, 2018) in the statistical software STATA (StataCorp, 2017) to analyze the data. In comparison with regular PCA, the approach taken in a Q-methodology study differs in that the PCA is conducted on the Q-sorts, rather than on the measurement items. This means that the retained factors represent clusters of Q-sorts originating from food system actors with similar perspectives on sustainability challenges and solutions. We used the factor loadings of the rotated factor solution (using Varimax rotation in the qfactor command), which represents the level of association between each Q-sort and the factors, to interpret the perspectives represented by each factor and in this way identify a set of narratives around food system sustainability, solutions, and challenges available among the participating Swedish food system actors. By inspecting the type of food system actor with which the highly ranking Q-sorts were associated, we were also able to draw conclusions about how the narratives were shared between different types of actors. The factors are at the core of our results, although it should be acknowledged that in studies based on Q-methodology there is no "objectively correct

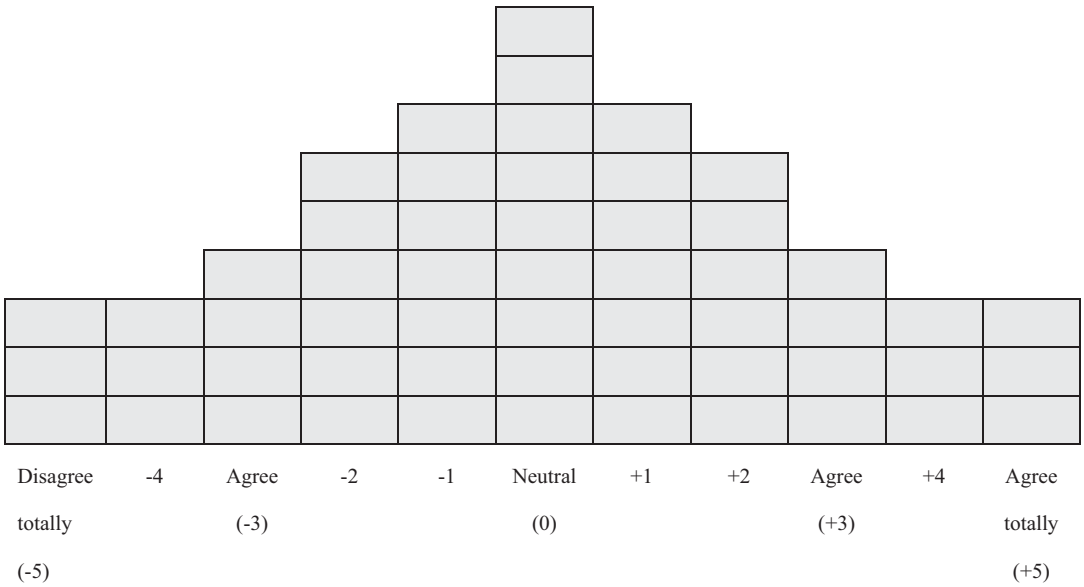


**Fig. 1.** Graphical visualization of the Q-sorting distribution. Participants were asked to rank the 55 statements according to the prompt on a scale 'Disagree totally' – 'Agree totally'. The forced-choice distribution ensured that few statements could be placed at the extreme ends of the scale.

number of factors" (Sneegas et al., 2021). However, in factor analysis a simpler solution with fewer factors is generally preferred to a more complex solution.

#### 3.2.5. *Interpretation of results*

After completing the statistical analysis, the perspectives identified were briefly described, translated, and sent to all stakeholders who had participated in the previous workshops and to all actors invited to participate in the sorting exercise. These stakeholders were then invited to participate in a workshop; 52 stakeholders attended and were split into five groups. In the workshop, the perspectives were again presented briefly to the groups, which discussed the different perspectives one at a time. Perspective names or communities of practice represented in the different perspectives were not presented to stakeholders in the discussion. These workshop discussions were recorded, transcribed, and used in interpreting the perspectives.

By examining the range of rankings of statements, we also identified main similarities ("consensus points"), differences ("compromise points"), and points that were non-consensual but non-confrontational, in order to discuss entry points for action (Webler et al., 2009).

## 4. Results and discussion

### 4.1. *Identifying perspectives on food system sustainability*

The PCA returned 10 factors with eigenvalue >1, but after inspecting the scree plot and analyzing the resulting factors, a solution with only five factors was considered meaningful to interpret. The factors considered accounted for a total of 58.7% of the variation, distributed as follows: Factor 1: 26.2%; Factor 2: 13.1%; Factor 3: 9.0%; Factor 4: 5.4%; Factor 5: 4.9%. Table 1 provides summaries of the five interpreted factors, including labels, numbers, and representatives of communities of practice involved. These five factors were taken to represent the dominating perspectives on food system sustainability challenges and solutions present among the Q-sorts. Interestingly, all perspectives except perspective 5 comprised Q-sorts from more than one community of practice. It can be noted that 32 Q-sorts loaded on the interpreted factors and we did not find any confounding Q-sorts loading on multiple factors. Four insignificant Q-sorts were found, represented by the large processing industry (2), conventional agriculture (1) and the retail sector (1). Perspectives are described in more detail in sections 4.1.1–4.1.5, while Table 2 presents rankings of statements across the five perspectives. Those rankings were used as a basis to characterize each perspective in detail and to highlight similarities and differences between perspectives.

**Table 1**
Overview of the five perspectives identified through Q-methodology. Values in brackets indicate number of Q-sorts from each community of practice.

| | Perspective 1 | Perspective 2 | Perspective 3 | Perspective 4 | Perspective 5 |
|---|---|---|---|---|---|
| Label | The *diagnostic* perspective: All hands on deck to fix the climate | The *regenerative* perspective: Diversity, soil health and organic agriculture to the rescue | The *fossil-free* perspective: Profitable Swedish companies to rid agriculture and the food chain of fossil fuels | The *consumer-driven* perspective: A wish-list of healthy, high-quality and climate-friendly foods | The *hands-on* perspective: Tangible solutions within the reach of consumers and the food industry |
| No. of Q-sorts | 11 | 8 | 6 | 4 | 3 |
| Communities of practice | Large processing industry (4)<br>Tech company (1), Retail (1)<br>Anim. welf. Org. (2), Agroeco. (1), Public auth. (1), Environ. org. (1) | Public auth. (1)<br>Environ. org. (3)<br>Organic farming (3)<br>Conv. farm. (1) | Conv. farming (3)<br>Large process. Ind. (3) | Public auth. (1)<br>Consumers (1)<br>Small processing industry (1)<br>Tech company (1) | Large processing industry (3) |

**Table 2**
Rankings of the 55 statements by the five perspectives on food system sustainability among Swedish food system actors. Statement ranking scores from the Q-sort range between −5 ("least like how I think") to +5 ("most like how I think"). Increasing strength of agreement with a certain perspective is shown by darker shades of green, and increasing disagreement by darker shades of orange. Statements with the greatest disagreement between perspectives are marked in blue and those with the greatest agreement between perspectives are marked with yellow. Aspects that some perspectives feel strongly about, while others are neutral, are marked in bold.

| No. | Statement | Perspective | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 1 | **People must be able to buy and consume good-quality healthy foods.** | 2 | 1 | 2 | 5 | 4 |
| 2 | Animal welfare should be considered an equally important dimension of sustainability as environmental, economic, and social sustainability. | 2 | -1 | 4 | 5 | 0 |
| 3 | **The actors in the Swedish food industry have a responsibility to ensure that the products available on the market are sustainable.** | 4 | 2 | 0 | 3 | 4 |
| 4 | International trade ensures aspects such as diversity in available foods, efficient production, and continuous access to food. | -2 | -4 | -4 | 0 | -3 |
| 5 | Knowledge and capacity building in companies is a way forward to create a better innovation environment and develop future solutions to the challenges of agriculture. | 0 | -2 | 2 | 2 | 2 |
| 6 | The broken cycle between urban and rural areas is a major challenge. | -3 | 3 | -1 | -1 | -3 |
| 7 | **Swedish farmers and the Swedish food industry must adapt their production to future climate change.** | 3 | 0 | 4 | 5 | 5 |
| 8 | The climate impact of agriculture needs to be greatly reduced in order to achieve climate neutrality by 2050. | 5 | 3 | -2 | 4 | -1 |
| 9 | **The green sectors are part of the solution when it comes to solving the climate challenge.** | 2 | 2 | 5 | 2 | 0 |
| 10 | **Reduced impacts on biodiversity are central to environmental sustainability.** | 3 | 4 | 1 | 0 | 1 |
| 11 | To effectively reduce greenhouse gas emissions, the focus needs to be on the large carbon dioxide emitting sectors, *i.e.*, on energy and transport. | 0 | -3 | 2 | 2 | -3 |
| 12 | Profitable companies are the basis for sustainability. | -1 | -3 | 5 | 0 | -2 |
| 13 | Increased value in production at farm level should come through a clear focus on quality food, rather than quantity production. | -1 | 3 | -3 | 3 | -1 |
| 14 | The opportunity for consumers to make informed choices is an important driver of change. | 2 | -1 | 1 | 0 | 3 |
| 15 | Legislation and other public polices (taxes, subsidies, information) are important to drive change in the food system. | 3 | 1 | -1 | 4 | 2 |
| 16 | The cultural values of food are important in a sustainable food system. | -5 | -1 | -4 | 3 | -5 |
| 17 | It is important to increase diversity in terms of crops and livestock, types of companies, and people involved in agriculture. | 0 | 3 | -2 | 4 | 2 |
| 18 | Increased food production in Sweden is important for the Swedish agricultural sector's competitiveness. | -4 | -2 | 1 | 0 | 3 |
| 19 | Meat production in Sweden should increase, because it is more sustainable than meat production in other countries. | -5 | -4 | 3 | -5 | -1 |
| 20 | Food is cheap because we let nature, animals, other people, future generations, and taxpayers pay in the form of climate change, loss of biodiversity, *etc.* | 4 | 5 | -2 | 1 | -1 |
| 21 | Spreading knowledge about food production to more people is important for sustainability in Swedish agriculture. | -1 | 0 | 0 | 2 | -4 |
| 22 | The retail sector needs to take greater responsibility for contributing to more sustainable Swedish food systems. | 2 | 0 | 3 | 1 | 1 |
| 23 | Fish and other foods from the sea and aquaculture are an important part of a healthy and environmentally sustainable diet and further efforts should be made to increase production and consumption. | -4 | -3 | -4 | -5 | 0 |
| 24 | Strategies to reduce hazardous chemical substances in food and nature are needed to ensure sustainable food systems in Sweden. | 0 | 2 | -2 | 2 | 2 |
| 25 | **Reducing food waste is one of the most important measures to achieve a sustainable food system.** | 5 | 0 | 2 | 2 | 5 |
| 26 | Use of fossil energy in agriculture and other parts of the food system must be phased out. | 4 | 1 | 5 | 1 | -1 |
| 27 | Health is a priority area of sustainability that should be considered throughout the food chain. | 0 | 1 | -1 | 3 | 0 |
| 28 | Schools and preschools involve all children and young people, and thus have a fundamental role in the work for good and equal health and an understanding of sustainable food production. | 1 | 0 | 1 | 1 | -1 |
| 29 | A sustainable food system should help create attractive landscapes. | -3 | -1 | -1 | -1 | -2 |
| 30 | Reducing the use of soy from rainforest areas is an important sustainability measure. | 2 | 1 | 3 | 1 | 3 |
| 31 | Consumption of food should be more adapted to that produced by local agriculture. | -2 | 2 | -1 | -2 | 1 |
| 32 | Short value chains need to be stimulated, including more small-scale local slaughterhouses and processing plants. | -2 | 4 | -2 | -2 | 0 |
| 33 | Supply based on season needs to control what we put on our plate to a greater extent. | 0 | 1 | 1 | -1 | 2 |
| 34 | Most identified environmental problems that arise in production are linked to highly specialized industrial agriculture, often on a large scale. | -3 | 5 | -5 | -5 | -4 |
| 35 | Livestock production is a good way to refine residual products and utilize resources in areas where it is difficult to achieve profitability in crop production. | -4 | -1 | 4 | -3 | -2 |
| 36 | There are good opportunities to produce more food with regenerative methods such as organic farming. | 1 | 5 | -3 | -3 | 3 |
| 37 | It is important to develop food packaging that can be recycled and that is only made from recycled or renewable materials. | 1 | -2 | 1 | 1 | 5 |
| 38 | Reduced meat consumption is crucial for Swedish diets to become more sustainable. | 5 | -3 | -5 | -2 | 0 |
| 39 | **Swedish agriculture should invest in producing more fruit, vegetables, and legumes, which we need to eat more of and where the degree of self-sufficiency is low.** | 1 | 0 | -1 | 0 | 4 |
| 40 | One goal of sustainable food systems is to be able to live and work throughout Sweden. | -5 | -2 | 0 | -1 | -1 |
| 41 | We need to develop a new ethic where we see ourselves as part of nature, and where our society's economy is seen as part of nature's economy. | 1 | 0 | -3 | -3 | 2 |
| 42 | A high degree of self-sufficiency is an important goal for Sweden. | -3 | 0 | 3 | 1 | 1 |
| 43 | In the face of future crises, government funds should be used to build better preparedness in primary production. | -1 | -1 | 0 | -2 | -2 |
| 44 | Social aspects such as working conditions, gender equality, and faith in the future need more attention in order to achieve sustainable food systems. | 0 | -2 | -1 | -2 | 0 |
| 45 | **A focus on soil health and working with ecosystems is central to solving many sustainability problems.** | 1 | 4 | 0 | 0 | 0 |
| 46 | Economic activity must stay within environmental limits and ensure a social basis for all. | 3 | 2 | 0 | -4 | 1 |
| 47 | Swedish agriculture needs to be developed technically, especially with regard to the use of digital technology. | 0 | -5 | 2 | -1 | -2 |
| 48 | Sustainable economic growth leads to technological development and innovation that is important for meeting the challenges of the food system. | -1 | -4 | 1 | -3 | -2 |
| 49 | There is great potential to save land and environmental impact by producing food in technical systems, *e.g.*, alternative proteins such as lab meat and plant-based meat substitutes, as well as vegetables in soilless systems. | -1 | -5 | -5 | -4 | -5 |
| 50 | An increased influx of young farmers is necessary to achieve a sustainable food system. | -2 | 0 | 0 | 0 | 1 |
| 51 | We should eat local food to support and increase the local economy and support local farmers. | -2 | 1 | 0 | -1 | 1 |
| 52 | We can optimize the inputs used on fields and reduce the climate impact through precision farming, digitization, and optimal management. | 0 | -5 | 2 | -1 | -3 |
| 53 | There is a lack of strategic ability for innovation in the Swedish food system. | -1 | -2 | -2 | -2 | -4 |
| 54 | Water management is an important sustainability aspect that must be prioritized. | 1 | -1 | 0 | 0 | 0 |
| 55 | The commercialization of agriculture, *i.e.*, food being seen as any commodity, is a fundamental problem in the food system. | -2 | 2 | -3 | -4 | -5 |

#### 4.1.1. The diagnostic perspective: All hands on deck to fix the climate

Those aligned with the *diagnostic* perspective had a clear environmental focus, giving a high ranking to statements on the environmental damage caused by agriculture (*e.g.*, statement #20, ranking +4), and on the need for economic activity to remain within environmental boundaries (#46, +3). Within environmental categories, the climate impact was emphasized, with the need for agriculture to reduce its climate impact (#8, +5) and phase out fossil fuels (#26, +4) given high rankings, although the need to reduce agriculture's impact on biodiversity was also acknowledged (#10, +3). However, specialization and industrialization of agriculture was not seen as the main problem (#34, −3). In parallel with the emphasis on climate mitigation in agriculture, well-established demand-side mitigation options were also given high rankings, *i.e.*, the need to decrease meat consumption (#38, +5) and reduce food waste (#25, +5).

In terms of change agents, this 'all hands on deck' approach highlighted the role of industry (#3, +4), public policy (#15, +3), and consumers (#14, +2) to enable change, although action from the food industry and policy-makers was ranked higher than informed consumer choice. Increased food production to enhance the competitiveness of the food sector (#18, −4), increased meat production in Sweden (#19, −5; #35, −4), and increased self-sufficiency (#42, −3) (all central parts of the Swedish food strategy; GOS, 2017) were ranked as less important aspects for Swedish food system sustainability. Social aspects of food systems were also downplayed, including the cultural values of food (#16, −5), rural development (#40, −5), and attractive landscapes (#29, −3). Moreover, the importance of fish and other seafood in a healthy and sustainable diet was ranked low (#23, −4).

Many workshop participants confirmed the existence of the *diagnostic* perspective, especially the strong focus on climate mitigation and a need to reduce meat consumption and food waste as a response. Workshop participants described how they view this quite technical approach that places less focus on social and cultural aspects of sustainable food systems:

> *"…it is quite stripped of people, consumers, culture and with a focus on reducing emissions, the industry, politics…it is a quite technical solution, … not associated with what people aspire…".*

> *"This [perspective] is out there…typical of this is its strong focus on measurability… that there should be measurable goals for it [the transition] to be easy…".*

Interestingly, this perspective, on which the greatest number of participants loaded and which accounted for the greatest variance, down-prioritized aspects that are central to the current Swedish food strategy, *i.e.*, increased food production in general, increased meat production, particularly in Sweden, and increased self-sufficiency. This is logical, as those aligned with this perspective had a clear environmental focus and increased production and especially increased meat production is difficult (or impossible) to combine with absolute reductions in *e.g.*, greenhouse gas emissions from Swedish agriculture. Such contrasting views can present serious challenges when the government requires certain stakeholders to feel committed to taking actions in line with their strategy.

In relation to food system sustainability narratives described in the literature, the *diagnostic* perspective included parts of narratives like Garnett's (2014) *demand-restraint* perspective in that demand-side solutions (reduced meat consumption and reduced waste) are heavily emphasized. However, it also gave high priority to the need to reduce emissions on the production side and phase out fossil fuels, *i.e.*, supply-side mitigation, reflecting findings in previous research that both demand and supply side mitigation is needed to reach climate targets (Bryngelsson et al., 2016; Clark et al., 2020).

#### 4.1.2. The regenerative perspective: Diversity, soil health and organic agriculture to the rescue

In terms of problems, those with the *regenerative* perspective placed emphasis on specialized and industrialized agriculture as a driver of environmental problems (#34, +5), the broken cycle between urban and rural areas (#6, +3), and a range of environmental and social costs associated with cheap food (#20, +5). In terms of environmental impacts, the need to preserve biodiversity (#10, +4) and the need for agriculture (and not only other sectors) to reduce climate impact (#8, +3; #11, −3) were seen as important, but biodiversity conservation was ranked higher than climate mitigation.

Regarding solutions, those adopting the *regenerative* perspective cited the potential of regenerative and organic agriculture (#36, +5), a focus on soil health (#45, +4), diversity in crops, companies, and people involved in food production (#17, +3), short value chains (#32, +4), and a focus on quality foods rather than quantity (#13, +3). Statements relating to different types of technological innovations were given the lowest priority, *i.e.*, the potential role of digitalization (#47, −5), precision agriculture (#52, −5), and producing food in technical systems (*e.g.*, lab meat) (#49, −5). Furthermore, those aligned with this perspective disagreed with the importance of economic growth (#48, −4), international trade (#4, −4), and a focus on profitability of companies as a basis for sustainability (#12, −3). The importance of Sweden producing more meat, justified by Swedish meat being more sustainable than production in other countries, was ranked low (#19, −4), as was the need to decrease meat consumption (#38, −3). As in the *diagnostic* perspective, the importance of fish and other seafood in a healthy and sustainable diet was also ranked low (#23, −3).

A vast majority of workshop participants stated that they clearly recognized this perspective and that they perceived it as the most consistent and clear perspective overall. It also conforms with other perspectives described in the literature, for example Garnett's (2014) *transformation perspective* and the *regenerative food system* described by Anderson and Rivera-Ferre (2021). Several participants noted that they would have expected local production to be ranked higher (#31, +2), as that is often a central, if not *the* most central aspect, among proponents of this perspective. Participants also noted that this perspective is found in niche groups, in academia, among the young on social media, among 'less professional' food system actors (*e.g.*, home gardeners, consumers detached from farming), in some TV shows and in environmental NGOs, often with an element of nostalgia and romanticization of agriculture. However, other participants opposed this (somewhat ridiculing and patronizing) view and pointed out that a *regenerative* perspective is also found among some influential thinkers in Sweden, based on a critique of the current economic system and a reluctance to accept problems associated with economic growth and the commercialization of agriculture.

The low ranking of the technology-related statements spurred some lively discussion in the workshop groups. Several participants stressed that this low ranking should not be interpreted as a general mistrust in technology, but rather a lack of belief in technology as *the* major solution, which it is all about how and by whom it is used (in line with the reasoning in the *regenerative* food systems described by Anderson and Rivera-Ferre (2021)).

> *"… it is a response to how highly technology is prioritized or seen as a solution…there is a very high level of trust [in technology] in many discussions, that it is technology which will get us out of the problems and should govern development."*

Some workshop participants believed that the low ranking of both statement #38, on the need to reduce meat consumption, and statement #19, on the need to produce more meat in Sweden, was contradictory, since in a Swedish food system more reliant on local foods, meat consumption would either have to decrease to meet domestic supply or domestic production would have to increase to meet current consumption levels. Other workshop participants offered an explanation for this

contradiction by pointing out that in this perspective, the amount of meat produced or consumed is not of foremost importance. Rather, it is *integration* of animals and cropping in mixed systems, using grazing cattle to manage grassland and upcycle low-quality biomass to food, that is the goal. Hence, having both a certain level of consumption and production of meat as a mitigation option *per se* does not make sense in this perspective.

#### 4.1.3. The fossil-free perspective: Profitable Swedish companies to rid agriculture and the food chain of fossil fuels

Those with the *fossil-free* perspective rated phasing out fossil energy in agriculture and beyond (#26, +5) as one of the most pressing needs. The green sectors (agriculture and forestry) were considered part of the solution in solving climate change (#9, +5) and the need for profitable companies (#12, +5) was rated highly important, as was climate adaptation in agriculture and food industry (#7, +4). Livestock production was considered a useful way to use residual products and land in areas where profitability in crop production is low (#35, +4). Increased production of (the more sustainable) Swedish meat (#19, +3) was ranked high, as was the importance of animal welfare (#2, +4) and reduced reliance on soy from rainforest areas (#30, +3). Increased self-sufficiency (#42, +3) was another highlighted area of importance and, in line with this, the role of international trade to supply diversity in foods, efficient production, and continuous access was ranked low (#4, −4). In terms of change agents, the statement that the retail sector should take greater responsibility for contributing to sustainability was ranked high (#22, +3).

Those aligned with the fossil-free perspective disagreed with the notion that environmental problems are linked to agriculture's high level of specialization, industrialization, and commercialization (#34, −5; #55, −3) or that there is a need for a new ethic (#41, −3). They also strongly disagreed with the need to decrease meat consumption (#38, −5). Further, the potential to produce more food in technical systems (*e.g.*, lab meat) (#49, −5) was ranked low, as was the potential to produce more food in regenerative or organic systems (#36, −3). Those with the fossil-free perspective also disagreed with the statement that quality foods should be prioritized over quantity production (#13, −3) and the importance of cultural values of food (#16, −4). As in the two previous perspectives, the importance of fish and other seafood in a healthy and sustainable diet was also ranked low (#23, −4).

A vast majority of workshop participants expressed strong recognition of this perspective in that it clearly and consistently echoed the sustainability narrative of current mainstream (conventional) primary producers and especially the main farmers' organization in Sweden, but also that of some politicians and public authorities. It was seen as *"a classic perspective, the absolute most common one*", as one workshop participant expressed it. In particular, a strong focus on profitability as a basis for sustainability and on phasing out fossil fuels as the main solution for food system sustainability was recognized. Some participants felt that the focus on fossil fuels could be used as a way to distract from other emissions of greenhouse gases from agriculture, maybe particularly those associated with meat production, and point to the climate impact of other sectors. In support of this suggestion, the statement on the need for agriculture's emissions to be drastically reduced to reach climate neutrality was ranked low (#8, −2).

> *"…what should I say, perhaps a little nasty, but this is very clearly a […] [farmer organization] perspective, where they, well rightly so, want to focus on the fact that there are other causes of climate impact than … agriculture…"*.

> *"…it sounds like a typical […][farmer organization] argument or perspective, you want to continue with meat production but you try to work to reduce the climate impact and to use less fossil energy …"*

In terms of narratives described previously in the literature, the fossil-free perspective shared parts of the *extractive food system* narrative (Anderson and Rivera-Ferre, 2021) in its emphasis on competitive and profitable companies and technology as a lever to solve environmental problems.

#### 4.1.4. The consumer-driven perspective: A wish-list of healthy, high-quality, and climate-friendly foods

Those with the *consumer-driven* perspective placed emphasis on healthy (#1, +5; #27, +3) and high-quality (#13, +3) food products (rather than bulk production), the need to include animal welfare as a sustainability dimension (#2, +5), and the need for diversity in terms of crops and livestock, types of companies, and people involved in agriculture (#17, +4). Food culture was considered to be another important food system sustainability aspect (#16, +3). The need to reduce climate impact in agriculture (#8, +4) and for Swedish farmers to adapt to future climate change (#7, +5) was acknowledged. At the same time, in a somewhat contradictory rating the need for economic activity to stay within environmental boundaries was ranked low (#46, −4), as was seeing specialization, industrialization, and commercialization of agriculture as drivers of environmental problems (#34, −5; #55, −4).

In terms of change agents, the state (through legislation and other public polices) (#15, +4) and the food industry (#3, +3) were seen as important actors. Increasing (the more sustainable) Swedish meat production (#19, −5), investments in fish and seafood (#23, −5), and the potential of high-tech foods (*e.g.*, lab meat) (#49, −4) were considered of lower importance. Regenerative methods (#36, −3) and using livestock to recycle residual products back into the food system (#35, −3) were also ranked low, as were the importance of economic growth for stimulating innovation (#48, −3) and the need for a new ethic centered around nature (#41, −3).

Several workshop participants viewed the *consumer-driven* perspective more as a random collection of (often contradictory) opinions and thoughts, rather than a consistent perspective. However, other workshop participants pointed out that in part, this perspective potentially represents the view of ignorant and trendy consumers, based on an (unrealistic) 'wish-list' of requirements on food products, *i.e.*, that foods should be healthy, diverse, high-quality, animal-, and climate-friendly. The lack of stated solutions, the skepticism about both regenerative and high-tech systems, and the lack of perceived potential in increased meat or seafood production were interpreted by workshop participants as reflecting a lack of understanding about farming, food processing, and the 'reality', and wanting the state and food industry to "*just fix it*". A few participants also raised the idea that this perspective could reflect the viewpoints of those with a very strong position on a specific issue, *e.g.*, animal welfare, climate mitigation, or food culture (the latter often seen as forgotten in the food system sustainability discourse according to one workshop participant) and perhaps with less interest and knowledge in other areas, explaining the inconsistency.

#### 4.1.5. The hands-on perspective: Tangible solutions within the reach of consumers and the food industry

Those with the *hands-on* perspective ranked reducing food waste (#25, +5) and use of recycled and renewable packaging materials highest (#37, +5), together with the importance of climate adaptation (#7, +5). Consumers and the food industry were considered important change agents, consumers through informed choice (#14, +3) and the food industry by ensuring the availability of sustainable foods on the market (#3, +4). The importance of the availability of healthy foods (#1, +4) was rated high, as was increased Swedish production, especially of fruit, vegetables, and legumes (#39, +4) and the use of regenerative or organic farming practices (#36, +3). Further, reducing the use of soy from rainforest areas (#30, +3) was seen as an important issue.

Specialization, industrialization, and commercialization of agriculture as drivers of environmental problems (#34, −4; #55, −5) were ranked low, as were the cultural values of food (#16, −5) and the role of international trade in supplying diversity and continuous access to food

(#4, −3). The potential to produce more food in high-tech systems (#49, −5) or reduce the climate impact through the use of precision farming and digitalization (#52, −3) was ranked low. In addition, despite the emphasis on consumers, spreading knowledge about food production to more people (#21, −4) was not seen as highly important. Those with the hands-on perspective did not agree that there is a lack of strategic ability for innovation in the Swedish food system (#53, −4), that the broken cycle between rural and urban areas (#6, −3) is an important issue, or that climate mitigation efforts should focus on sectors that are large carbon dioxide emitters (#11, −3), *i.e.*, on energy and transport (rather than agriculture).

Two possible interpretations emerged in the workshops. The first was that the hands-on perspective was simply a food industry/retailer perspective, as statements ranked highly represented hands-on, concrete, and possibly 'easier' sustainability-related solutions that food industry and retailers are currently employing, such as reducing food waste, improving packaging, climate adaptation of supply chains, reducing soy, and increasing organic products. The other interpretation was that the hands-on perspective is another consumer perspective, that of a slightly more informed consumer trying to do the right thing:

"*This is a consumer perspective, you easily end up thinking about packaging, you try your best in your daily life…you picked up that soy is bad…so this is about things you can do [as a consumer].*"

### 4.2. Entry points for change

In terms of consensus points, six statements were given a similar ranking across all five perspectives (statements on a yellow background in Table 2). Of these, only one statement was considered (moderately) important: the need to reduce the use of soy from rainforest areas (rank +1–3). Hence, none of the statements for which there was a high degree of agreement across perspectives was ranked at the extremes, *i.e.*, aspects which perspectives agree are not the most important.

However, several aspects were non-consensual but also non-confrontational, *i.e.*, some perspectives were ranked either of high or low importance while others were quite neutral (marked in bold in Table 2). Such statements could function as an entry point for action to achieve several goals. One such statement was ensuring that people can buy and consume good-quality healthy food (Table 2; #1). A healthy diet includes adequate intake of foods, more vegetables, legumes, and fruit, and moderate amounts of red and processed meat, all of which would also improve several aspects related to the environmental sustainability of diets. Hence, approaching the issue of sustainable diets through the health lens, rather than one in which decreased consumption of animal products is the starting point, might be a more fruitful way forward, as there was strong disagreement on the priority of decreased meat production (#19) and consumption (#38). However, there are also potential risks with this approach, including getting caught up in defining healthy foods. Moreover, since the most critical dietary change from a health perspective is reduced intake of discretionary foods and excess energy, and increased intake of vegetables and whole grains, decreased meat consumption might risk being overshadowed. Another entry point could be to focus on investments for increased production of fruit, vegetables, and legumes in Sweden (#39). Proponents of the hands-on perspective ranked this as important, while others were neutral. Using this as an entry point might produce a similar effect, where the meat controversy is avoided by focusing on another solutions.

Similarly, the need to reduce impacts on biodiversity was highly prioritized by proponents of the *diagnostic* perspective and the regenerative perspective, and those aligned with the other three perspectives did not oppose this. However, the statement related to biodiversity was on a general level and it is likely that proponents of the different perspectives would differ greatly in their view on *how* to preserve biodiversity, reflecting potentially the land sharing-land sparing debate (Phalan, 2018). It is likely that proponents of the regenerative perspective would support an approach in which land is 'shared', *i.e.*, used extensively with low inputs to allow for more wild species on farmed land, as opposed to a strategy in which some land is farmed more intensively and other land (at least in theory) is 'spared' for nature conservation, which might be proposed by other actors. The land sharing-land sparing debate might also arise from the disagreement across perspectives on the potential of regenerative/organic production.

The responsibility of the food industry, adaptation to climate change, reduced food waste, and the importance of soil health were other aspects for which proponents of some perspectives felt strongly while others were neutral. These might thus be additional potential entry points for action. However, it should be noted that these are simply entry points, while success in reaching agreement on food system sustainability goals and strategies through collaborative governance would require a range of factors, including building trust, resolving power and resource imbalances, and good leadership and facilitation (Ansell and Gash, 2008).

In addition, focusing only on non-consensual and non-confrontational aspects is unlikely to change food systems sufficiently in a sustainable direction, and might also distract from the systemic changes needed. Taking the example of livestock again, Swedish agriculture is heavily reliant on animal rearing, with 70% of agricultural production value coming from livestock or feed production (SBA, 2020a, 2020b). Reduced livestock consumption, and hence reduced production globally, has been shown to be key to improving environmental sustainability in food systems (Röös et al., 2017; Springmann et al., 2018), but the perspectives captured in the present study show that there is still major disagreement regarding the need to reduce meat consumption in Sweden (#38) and the role of livestock in Swedish agriculture (#19, #35). A divide was seen between actors aligning with the *fossil-free* perspective who, in line with the Swedish food strategy (GOS, 2017), put high priority on increased Swedish meat production for increased self-sufficiency and competitiveness, and those aligning with the *diagnostic* and regenerative perspectives, who strongly disagreed with this strategy. Among those with the fossil-free perspective, increased meat production in Sweden was even seen as delivering climate benefits, as more 'climate-friendly' Swedish meat could replace meat production with higher emissions on global markets.

Despite Sweden's success in tech entrepreneurship in many other economic sectors, with companies such as Ericsson, ABB, Spotify, Klarna, Skype, *etc.*, there was little trust across perspectives in the potential to produce more food in technological systems (#49). While this might be logical for proponents of the regenerative perspective, which relied more on nature-based strategies and a land-sharing approach, it is somewhat surprising to see that across all perspectives there was little faith in such innovative technologies playing a part in future sustainable food systems in Sweden.

### 4.3. Study limitations

Several respondents from each type of community of practice were invited to complete the Q-sort, however it should be acknowledged that our analysis is based on data collected from respondents who were somewhat biased towards the community of practice 'large-scale processing industry'. There are several possible reasons for this, most notably that this community of practice represent a significant economic share of the Swedish food value chain and that the type of organizations represented in this community of practice have staff-members specifically employed to focus on the sustainability of their operations. This means that respondents from this category of practice may be more available and motivated to participate in a study like this. For our results, this means that some perspectives on food system sustainability and solutions might have been missed while several more nuanced perspectives from the same community of practice might have emerged. A larger pool of potential respondents from each community of practice could have been approached to complete the sorting exercise by *e.g.*, not inviting stakeholders to validate the statements. However, we deemed

this validation step important and thus accepted the trade-off. It should also be noted that representatives of the different communities of practice were mostly distributed across the found perspectives, rather than clustered on single perspective. This underlines, in line with the literature (Cuppen et al., 2010), that although respondents represent the same community of practice they do represent heterogeneous perspectives on food system sustainability and solutions.

Additionally, there were a number of internal inconsistencies in the perspectives. Inconsistencies are to be expected, to some degree, given that perspectives on highly complex, multi-faceted topics such as food systems are not always internally consistent. That said, some of these inconsistencies could have been explained through follow-up interviews with participants.

## 5. Conclusions

Five food system sustainability perspectives held by Swedish food system actors emerged in our analysis. Three of these were identified by us and by food system actors as consistent and contrasting perspectives commonly found in the Swedish discourse, while two were interpreted as reflecting loosely connected, but tangible, aspects relating to a smaller subset of actors (consumers and industry). One of the three main perspectives, the *diagnostic* perspective, placed high priority on reduced meat consumption, reduced food waste, and decreased climate impact in agriculture, *i.e.*, both demand- and supply-side interventions. However, it downplayed strategies highlighted in the current Swedish food strategy and social aspects of food system. This lack of alignment with current policy and lack of acknowledgement of the 'softer' aspects of food systems is why we interpreted this as a *diagnostic* climate mitigation-oriented perspective. An alternative *regenerative* perspective highlighted industrialized large-scale farming and lack of internalization of external costs as the main problems, and *e.g.*, diversity, soil health, and organic farming as the main solutions. In contrast, proponents of a *fossil-free* perspective did not share this problem description at all, and rated phasing out fossil fuels, increased profitability of companies, increased meat production, and self-sufficiency as the main priorities. This was interpreted as a 'status quo' farmers' organization perspective, while also reflecting several parts of the current Swedish food strategy. These highly contrasting views on food system sustainability problems and solutions among Swedish food system actors can be a major barrier to transforming the Swedish food system towards greater sustainability. However, a number of entry points for change (*i.e.*, aspects that some actors rated highly important and others considered neutral) were identified. One involved focusing on healthy diets and increased production of fruit and vegetables, instead of on the highly polarized issue of meat consumption and production. Other potential entry points for change were biodiversity conservation, the responsibility of the food industry, adaptation to climate change, reduced food waste, and the importance of soil health. By focusing on these, common ground could hopefully be found among actors, enabling trust-building before moving to discussions about the larger and more sensitive systemic changes needed for food system transformation.

## CRediT authorship contribution statement

**E. Röös:** Conceptualization, Methodology, Investigation, Writing – original draft. **A. Wood:** Conceptualization, Methodology, Writing – review & editing. **S. Säll:** Conceptualization, Methodology, Investigation, Writing – review & editing. **A. Abu Hatab:** Investigation, Writing – review & editing. **S. Ahlgren:** Investigation, Writing – review & editing. **E. Hallström:** Investigation, Writing – review & editing. **P. Tidåker:** Investigation, Writing – review & editing. **H. Hansson:** Conceptualization, Methodology, Investigation, Formal analysis, Writing – review & editing, Supervision, Project administration, Funding acquisition.

## Declaration of Competing Interest

The authors have no competing interests to declare.

## Data availability

Data will be made available on request.

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