Received: 1 February 2023 | Revised: 20 July 2023 | Accepted: 28 July 2023

DOI: 10.1002/sd.2718

REVIEW ARTICLE

Sustainable Development | WILEY

Sustainable food consumption and Sustainable Development Goal 12: Conceptual challenges for monitoring and implementation

Kristina Mensah[1] | Christine Wieck[1] | Bettina Rudloff[2]

[1]Agricultural and Food Policy Department, University of Hohenheim, Stuttgart, Germany

[2]German Institute for International and Security Affairs, Berlin, Germany

Correspondence
Kristina Mensah, Agricultural and Food Policy Department, University of Hohenheim, 70599 Stuttgart, Germany.
Email: kristina.mensah@uni-hohenheim.de

Abstract

In recent years, policy initiatives have been developed to promote sustainability. Although sustainable food production is an integral part of many national agricultural policies, this is not the case for sustainable food consumption. This article systematically reviews key elements of sustainable food consumption and evaluates how they align with existing policy indicators, specifically SDG 12, within the context of the agricultural policy of the European Union. Through a cross-referencing approach, this article identifies gaps and possible improvements in policy indicator frameworks to better capture elements of sustainable food consumption. We find that SDG 12 targets are not suitable to assess progress to sustainable food consumption. While targets are closely linked to environmental and economic issues, they are insufficient to monitor sustainable food consumption. Our findings suggest the necessity for enhanced or modified policy indicators that encompass the key elements of sustainable food consumption as well as a comprehensive definition of the latter to effectively design and evaluate polices on this matter.

KEYWORDS
cross-referencing, European Union, food, indicator, monitoring, sustainability, sustainable diets

1 | INTRODUCTION

The past century has seen drastic changes on a global scale in agricultural production systems that have led to a substantial decrease in the prevalence of hunger in most countries (WBAE, 2020). However, while global food availability and access have increased, healthy and sustainable diets are still not widely available. (FAO, 2020; Herforth et al., 2022; Willett et al., 2019). A growing body of evidence indicates that the current food system in many countries does not encourage a healthy and sustainable diet (de Boer & Aiking, 2022; Johnston et al., 2014; Springmann et al., 2018; Willett et al., 2019). Furthermore, according to Crippa et al. (2021), the current food system is a significant contributor to global GHG emissions. This demonstrates the strong links between food production, food consumption, the environment, and public health.

In response to these challenges, the European Commission recognises that the current food system in the European Union (EU) is insufficient to address the increasing number of diet-related diseases and the adverse environmental effects of current diet patterns (European Commission, 2020). To address this, it presented the Farm-to-Fork Strategy (F2F) as part of the European Green Deal in 2020. Since then, a string of policies and action plans are being developed to achieve the set goals that have the potential to fundamentally alter the European food landscape (European Commission, 2022b; Hopwood et al., 2005; Schebesta & Candel, 2020). However, yet an area fundamentally to be addressed by European legislative work is

sustainable food consumption (SFC), with efforts so far focussing mainly on food production (De Schutter et al., 2020). In general, translating sustainability into actionable policies is complex and requires an approach that is multidimensional and integrative considering all relevant actors (Weitz et al., 2018). While policies to improve the sustainability of production are directed to a specific group, namely producers, policies that impact consumption patterns have to address a much larger, heterogenous group of actors. This makes it much more complicated to design policies that effectively resonate with and influence the behaviour of all consumers (Garnett et al., 2014; Guyomard et al., 2012).

The nutritional and biochemical aspects of food consumption are only one of many, since food production, processing, preparation, and consumption touch on various elements both on an individual and societal level (Fieldhouse, 1995; Rayner et al., 2008; WBAE, 2020). Food plays a critical role in determining human health. It provides the necessary nutrients but can also directly be linked to an increased risk of diet-related non-communicable diseases such as cardiovascular disease or diabetes. Every year worldwide, approximately 4 million deaths are caused by non-communicable diseases related to food and being overweight (World Health Organization, 2019). In 2017, 950.000 deaths in the EU could be linked to non-communicable diseases (European Commission, 2020).

Moreover, the importance of food consumption for sustainability has been widely recognised. In 1992, the Earth Summit in Rio first acknowledged the importance of changing consumption and production patterns to foster sustainability (Lorek & Spangenberg, 2014). In 1994, the Oslo Symposium developed the first globally recognised definition for sustainable consumption 'the use of goods and services that respond to basic needs and bring a better quality of life, while minimising the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardise the needs of future generations' (Oslo Roundtable on Sustainable Production and Consumption, 1994). This definition has entered the Sustainable Development Goal (SDG) 12 ('Responsible production and consumption'). The SDGs of the United Nations (UN) are intended to be universal goals that apply to all countries and that link the economic, social, and environmental dimensions of development (UN, 2015). Although SDG 12 is most directly related to SFC, the latter also touches on other SDGs such as SDG 1 ('no poverty'), 2 ('no hunger'), 3 ('good health and well-being'), 13 ('climate action'), 14 ('life below water'), and 15 ('life on land') (Le Blanc, 2015; Rocha & Spagnuolo, 2019; Scharlemann et al., 2020; Stockholm Resilience Centre, 2016).

This led to recent debates promoting the 'system idea' which emphasises that food consumption is only one part of the larger food system (Fanzo et al., 2020; Fanzo & Davis, 2021). Most recently, the UN Food System Summit in September 2021 highlighted the importance of SFC as an element in the food system (von Braun et al., 2021). The SDGs have been an important part of European policymaking and have been a mainstay of recent European initiatives, strategies, projects, and respective indicators. F2F aims to transition the EU's food system so that a 'fair, healthy and environmentally friendly' system can be achieved. The F2F strategy has different levels of intervention that can be linked to fostering SFC, from tax incentives to public procurement and consumer empowerment (European Commission, 2020). However, clear targets, transition trajectories, and a strong monitoring system will be needed.

This context has led us to conclude that to understand SFC, a comprehensive overarching perspective is necessary that integrates the dimensions of production, consumption, the environment, and public health. Therefore, a comprehensive monitoring and evaluation system comprising a set of relevant indicators is key to assessing whether a policy fosters these sustainability dimensions (Hebinck et al., 2021).

This sets the framework for our research question: Do existing SDG indicators, specifically those linked to SDG 12, cover elements of SFC? Can they be used to measure progress toward achieving SFC?

These topics have been addressed in the existing literature (e.g., Burlingame & Dernini, 2010; Fanzo, 2019; Garnett et al., 2014; Wieck et al., 2019; Willett et al., 2019); however, we still see a research gap in the analysis. Are the existing policy monitoring indicators suitable to cover the different dimensions of SFC and are the international SDG-related indicators suitable for the EU F2F case? Hence, using the EU F2F proposal as a case study, this article focuses on SFC, how it is captured by existing policy indicators, and if these policy indicators are suitable to measure progress towards SFC.

For this, in a first step, the concept and key elements of SFC are reviewed. Next, cross-referencing is carried out at the global and EU levels for key elements that constitute SFC with existing policy indicators. This is done first for the existing SDG 12 indicators; in a second step, a larger set of relevant SDG indicators related to food consumption is used. With this research, we fill a gap in the often more general literature (Hák et al., 2012; Herman & Shenk, 2021; Kubiszewski et al., 2022; Lehmann et al., 2020) taking a systematic approach to assess the adequacy of existing indicators to capture the elements of SFC. Assessing how indicators capture key elements can be crucial to effective policy evaluation and monitoring. Therefore, our article can contribute to the literature by improving the understanding of evaluating SFC policies using a set of existing policy indicators.

The remainder of this article is structured as follows. In Section 2, we provide an overview of the material and methods used. In Section 3, we identify key elements of SFC and link them to SDG 12 and other SDGs using cross-referencing as a method. The conclusions are drawn in the final section.

2 | MATERIALS AND METHODS

2.1 | Research design

Our research design to answer our research questions comprises four steps (see Figure 1) and is based on different qualitative approaches and data. We started with a short systematic review of the literature to extract the relevant literature that defines the concept of SFC. Based on the literature found, we distil key elements that constitute,

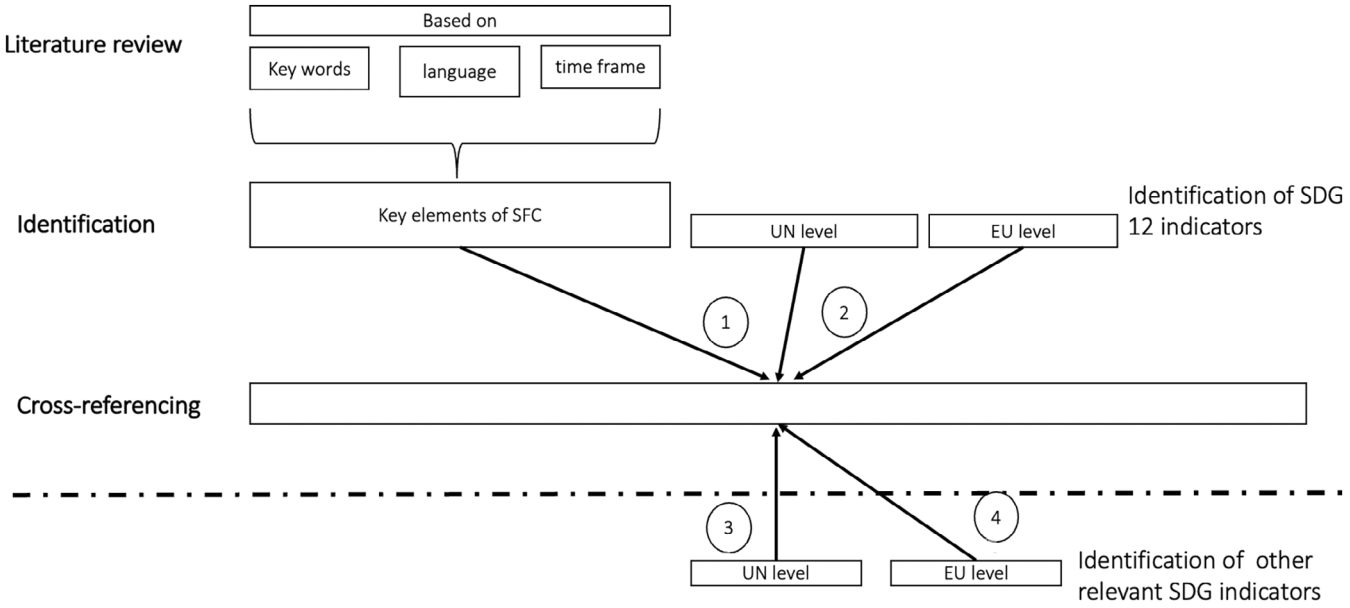

FIGURE 1 Approach. *Source*: Own illustration.

according to the literature, SFC. Next, we focus on the policy indicators defined by the UN and the EU to monitor the progress of SDG 12. Using these indicators, we examine whether they capture the content of the key elements of SFC that we had identified in the first step. In this step, we followed an approach used by Scown and Nicholas (2020), who compiled a list of key elements and analysed their alignments with SDG indicators. Third, by developing a cross-reference table, we tried to match the key elements of SFC with the SDG 12 indicators used at the global and EU level. This comparison explores whether indicators capture key elements of SFC and therefore constitute a suitable tool to measure progress toward SFC. Previous studies (e.g., Sterling et al., 2020) systematically comparing SDG indicators to other indicators have chosen a similar approach. This process allows for a comprehensive qualitative assessment of how well current indicators address the key elements of SFC. In addition, we follow (Scown & Nicholas, 2020) in their argumentation that aligning indicators with key elements based on their wording reduces subjectivity in the process since indicators that can be measured are formulated more precisely than more generally formulated indicators.

In a fourth step, we broadened the approach and included other SDGs that may also have a link to SFC. Here, again, we examine the indicators of the related SDGs and how they match our defined list of key elements.

2.2 | Data collection and analysis

We use two approaches to collect the relevant information necessary for our analysis: a systematic review of the literature to define the key elements that make up SFC and secondary data on SDG indicators from sources from the UN and EU.

To gather the relevant literature for the definition of SFC, we performed a systematic review of the literature. We limited our search to specific keywords to prompt search results that adhere to our research questions. The following search terms were used: 'sustainable food consumption', 'sustainable diets', 'SDGs AND sustainable food consumption'. The search was limited to primarily English literature and the period 2005–2021, although for more general definitions of sustainability and sustainable consumption, we referred to publications from the years 1987 and 1992. Scopus, Google Scholar, and PubMed databases were used. Using the first search term, we found 15.034 publications, using the second 9.995 publications, and 3.376 publications using the last term. By deleting double entries, we then screened abstracts and keywords scanning for thematic relevance. Papers were considered relevant if they focused on defining SFC. We excluded all papers that did not provide a single-standing definition of SFC. This left us with 19 publications that we used to distil key elements that, according to the scientific literature, constitute SFC. To extract key elements of SFC, we categorized information into themes. We then analysed the themes to identify the elements that most frequently occurred in SFC as defined by the literature.

The second piece of information we needed for the study came from the UN SDG process. In 2015, indicators and targets were introduced to underline and monitor the global SDG agenda (UN, 2015). Regarding SDG 12, it comprises 11 targets and 12 indicators,[1] but as discussed above, other SDGs also refer to sustainable consumption. These indicators are based on the most recent list of the Inter-Agency and Expert Group on Sustainable Development Goal Indicators for the UN indicators. The achievement of the goals only depends on the UN member states to translate and integrate them into their policies and strategies (Persson et al., 2016). Thus, when analysing at the country

[1] https://sdg-tracker.org/sustainable-consumption-production.

(or regional block) level, one must also look at the respective national (or regional) statistics. For this article, we took a closer look at the EU indicators. The EU has translated the UN SDG indicators into 100 EU indicators that adequately reflect the EU context (European Commission, 2018). The indicators were first developed in 2017 and are reviewed annually (Eurostat, 2021). This forms the basis for our second part of the analysis.

3 | RESULTS

3.1 | Key element of SFC

There seems to be no general agreement on the definition of SFC. A range of definitions focuses on different aspects of SFC (Garnett et al., 2014). Depending on the focus of the definition, the narrative changes slightly, meaning that the emphasis is sometimes placed more firmly on the environment, while other definitions underline nutritional aspects. Before looking at the definitions of SFC, it is interesting to break down the term itself. How 'sustainable', 'food', and 'consumption' can be defined is important to understand the definitions of SFC as a term. In general, the definitions of 'sustainable' differ greatly depending on the perspective and weight that different actors place on aspects of sustainability. In 1986, the Brundtland Report stated that 'Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland & Khalid, 1987). This is a broader definition that is not limited to a specific element. There are other definitions that more narrowly understand sustainability in the context of the environmental element. Both approaches have clear advantages. A definition that is too narrow can oversimplify, while a definition that is too broad could be overwhelming and impractical to adopt in daily life (Garnett et al., 2014). When focusing on sustainability in the context of food consumption, it is evident that a mixture of narrow and broad definitions can be used. From a nutritional perspective, food provides energy for vital processes and consists mainly of carbohydrates, protein, fat, and micronutrients. Most foods are of plant and animal origin and are produced by the agricultural sector. It is an element that all humans identify with; it represents cultural belongings and dietary patterns that cannot be explained solely by the nutritional goal of homeostasis. Food systems are located at the local, national, and global levels. They differ in several aspects, while also consisting of the same fundamental elements (von Braun et al., 2021). In the economic field, consumption means that economic actors consume goods and services to fulfil a need (Hashimzade, 2017). This need can present as a physiological necessity, a pleasure, or both. Food consumption is shaped by the availability, access, and utilisation of food over time and factors such as preferences, traditions, fashion, and psychological needs (Reisch et al., 2013). Therefore, SFC touches on several aspects of consumption. Although a diet that is SFC-sound can be environmentally friendly, this does not translate into a preferred diet that people accept to incorporate into their daily choices. Özkaya et al. (2021) stated that environmental protection, consideration of the needs of future generations, and satisfaction of fundamental needs are relevant factors for SFC. The later-presented definitions result from a literature review. The relationship between sustainability and dietary habits has been investigated by researchers, primarily economists and ecologists, who have produced solid theoretical models and empirical evidence that clarify the environmental consequences of diets and assess alternatives against various sustainability measures (Duchin, 2005). The identified definitions have been shaped by different scientific fields, such as nutritional, behavioural, environmental, or economic sciences.

Figure 2 presents the most commonly mentioned aspects in the identified SFC definitions from the literature. The Oslo Roundtable definition of sustainable consumption is broad, as it refers to the production, consumption by the consumer, the well-being of individuals, and considering future generations (Oslo Roundtable on Sustainable Production and Consumption, 1994). This definition is not explicitly directed at food consumption but covers relevant aspects that have been further developed in other definitions. For example, the UK Sustainable Development Commission described sustainable food as safe, healthy, and nutritious for consumers, providing a livelihood for producers, respecting environmental boundaries, and supporting rural communities (UK Sustainable Development Commission, 2005). Here, emphasis is placed on the connection and dependencies between the consumer and the producer. The report by the German Scientific Advisory Board on Agricultural Policy, Food, and Consumer Health Protection recognised four goals to achieve SFC: health, social aspects, environment, and animal welfare (WBAE, 2020). Lang and Barling emphasise that SFC is fuelled by reducing meat and dairy consumption and increasing fruits and vegetables with respect to individual behaviour (Lang & Barling, 2013). This definition provides a guideline for implementing SFC and, therefore, differs from the above definition.

Although many definitions have identified different aspects that affect SFC (see Figure 2), some focus on one aspect. When reviewing the available literature, two terms are often used interchangeably: SFC and sustainable diets. The following definitions focus on sustainable diets and dietary patterns. Human health can be the result of diet patterns (Fanzo, 2019). Diets are often measured against the frequency of certain foods consumed, focusing on the process of production or their nutrients. In 2010, the FAO presented a definition with an extensive scope: 'Sustainable Diets are those diets with low environmental impacts, which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy while optimising natural and human resources (…)' (Burlingame & Dernini, 2010). Mertens et al. introduced the concept of SHARP diet that is built within the framework of environmentally sustainable (S), healthy (H), affordable (A), reliable (R), and preferable (P) (Mertens et al., 2017). This concept goes beyond a dietary guideline and can be seen as an overall approach to SFC. Due to its scope, this definition might make a

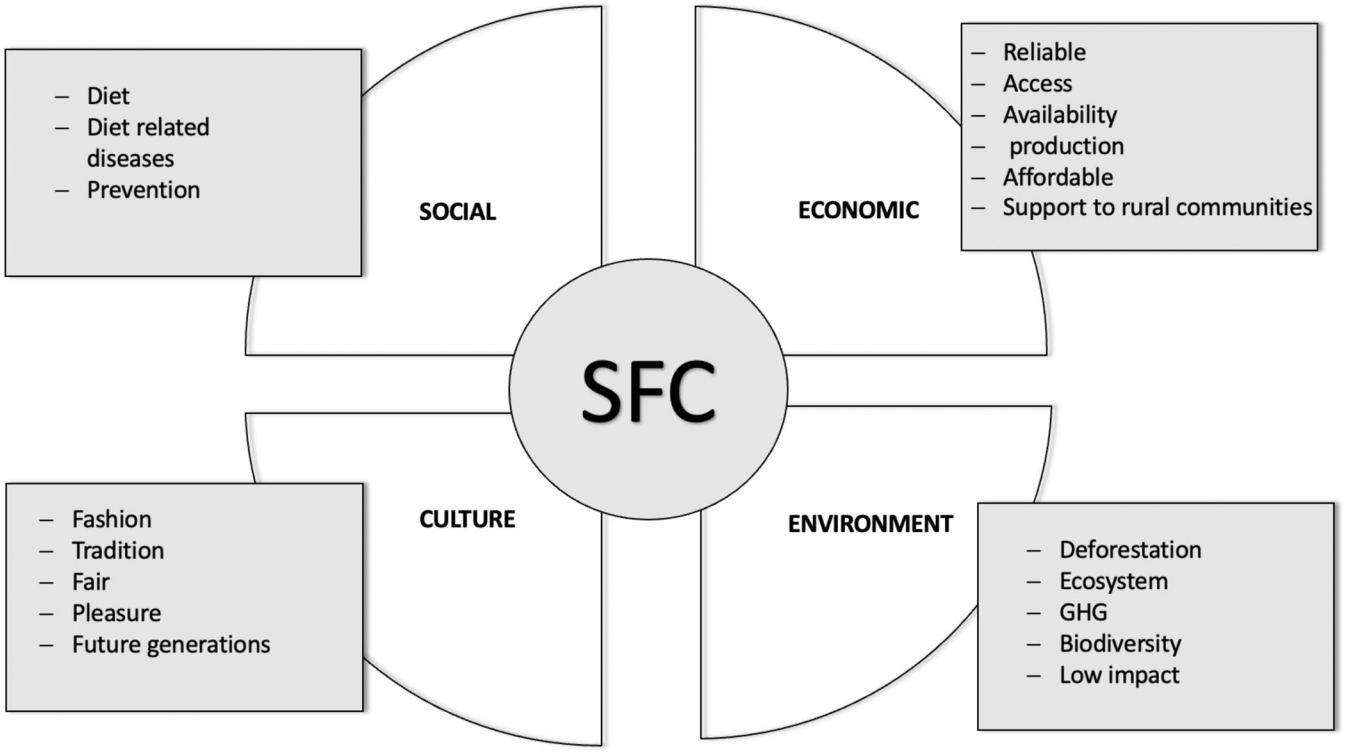

FIGURE 2 Visualisation of elements of SFC based on the literature review. *Source*: Own illustration based on literature review.

practical approach to SFC complicated. The WHO describes a sustainable and healthy diet as a diet rich in vegetables, fruits, whole grains with limited consumption of saturated fats, sugar and salt (WHO, 2018). The EAT-Lancet Commission has defined a healthy diet as one that includes the dimensions of health and environment (Willett et al., 2019). This diet promotes the consumption of a large amount of vegetables, fruits, whole grains, legumes, nuts, unsaturated fats, a moderate amount of seafood and poultry, and no or low amounts of red meat, processed meat, added sugar, starchy vegetables. Garnett et al. described a sustainable diet as a diet that has a much lower effect on the environment but is healthier at the same time. In their model that focuses on the consumer as an agent of change, Lucas et al. described that the optimal sustainable diet for the UK could be achieved through '(…) significant reductions in dairy, meat, eggs, sweeteners and oils/lard which are compensated by an increase in starchy staples (cereals, potatoes) fish, seafood, vegetables, legumes and nuts' (Lucas et al., 2021, p. 886). They also show that an affordable diet that covers all nutritional needs may not be the best from an environmental perspective and vice versa (Lucas et al., 2021). Their findings are consistent with the recommendations of the EAT-Lancet Commission. Reduced consumption of animal-based products is often seen as the primary option to reduce the environmental impact related to diet (Hallström et al., 2015). In their systematic review, Wilson et al. found that a sustainable diet is largely plant-based with a reduction in meat consumption (Wilson et al., 2019). Four key elements of SFC could be identified: health, socioeconomics, sociocultural, and environment (see Table 1), as well as keywords that were repeatedly used. This will be cross-referenced in the next step with the SDG indicators.

TABLE 1 Identified key SFC elements.

Health	Socioeconomics
Diseases, diet	Affordable, available, production, cost, price, access, reliable, support to rural communities
Sociocultural	**Environment**
Future generation, pleasure, tradition, fair	Soil, land, sustainability, emissions, water, air, biodiversity, waste, environmental goods

Source: Own compilation.

With policy monitoring and implementation of SFC in mind, we conclude the following: (1) the SFC definitions are extremely broad and touch upon different policy fields, (2) we can observe a strong emphasis on either environmental or nutritional elements, (3) socioeconomic factors can only be stated in a broad term so that the economic issues are captured adequately on a global scale. (4) However, it becomes also clear that the socio-cultural SFC refers to food consumption that covers several aspects of sustainability while also acknowledging the sociocultural and health aspects of food. Capturing the key elements of SFC is a critical step for the process of cross-referencing because it provides a definitive framework through which the relation of indicators can be assessed. We will use the identified key elements of SFC as the basis for cross-referencing in the following parts.

3.2 | The key elements of SFC reflected in SDG 12 targets and indicators

Based on the identified elements of SFC, we analyse how the identified key elements that make up SFC are reflected in the applicable targets and indicators of the UN and the EU that are used to measure progress toward the achievement of SDG 12.

The first set of the analysis focuses on the UN SDG indicators. SDG 12 comprises 11 targets and 12 indicators (see Table 2). It includes eight specific targets (12.1–12.8) and three implementation targets (12.a–12.c). Most targets are expressed in a voluntary way. Only 12.c, which deals with the removal of fossil fuel subsidies, has developed precise regulatory requirements. SDG 12 is not limited to food consumption but covers all aspects of production and consumption. Therefore, most indicators cannot be directly linked to food except 12.3 'Halving per capita global food waste'. The target has been criticised for its lack of global understanding of food loss and limited data (Xue et al., 2017). It covers not only food consumption but also food production (Gasper et al., 2019). Although no SDG specifically mandates diet changes, 12.8 'Promote universal understanding of sustainable lifestyles' underlines the importance of raising public awareness. Targets 12.3 and 12.8 are also the only ones that directly address consumers, though not exclusively (Gasper et al., 2019). Table 2 presents the links of SDG 12 with key elements of SFC. We can observe a stronger emphasis on the economic and environmental elements of SFC. This underlines the previous

TABLE 2 Cross-referencing of SDG 12 and key elements of SFC.

	SFC elements			
UN SDG indicators	**Health**	**Economy**	**Culture**	**Environment**
12.1.1 Number of countries developing, adopting or implementing policy instruments aimed at supporting the shift to sustainable consumption and production				
12.2.1 Material footprint, material footprint per capita, and material footprint per GDP				
12.2.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP				
12.3.1 (a) Food loss index and (b) food waste index				
12.4.1 Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement				
12.4.2 (a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment				
12.5.1 National recycling rate, tons of materials recycled				
12.6.1 Number of companies publishing sustainability reports				
12.7.1 Degree of sustainable public procurement policies and action plan implementation				
12.8.1 Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment				
12.a.1 Installed renewable energy-generating capacity in developing countries				
12.b.1 Implementation of standard accounting tools to monitor the economic and environmental aspects of tourism sustainability				
12.c.1 Amount of fossil-fuel subsidies (production and consumption) per unit of GDP				
No link				**Positive link**

Source: Own compilation based on UN indicators (United Nations, 2022).

assumption that SDG 12, while also covering consumption issues, has a strong perspective on production. The SDG 12 target with the strongest link to food is 12.3. The target was divided into two parts, (a) focusing on food loss on the supply side and (b) focusing on food waste on the consumption side, specifically through retail and consumers (Fabi & English, 2018). The distinction between loss and waste makes the overall data collection complex. In particular, food waste by consumers is difficult to estimate due to the lack of availability and quality of the data (Gasper et al., 2019). The health and cultural elements of SFC are not or only to a small extent reflected in the UN SDG 12 targets and indicators. This shows that the more holistic and broad definition of SFC, including health, economic, cultural, and environmental aspects of sustainability, is not considered in its entirety in SDG 12.

In the second set of the analysis, we focus on the EU's approach to SDG 12. Narrowing the application of SDG 12 in Europe requires assessing the progress of the EU toward achieving SDG 12 and its monitoring system. In the EU, SDG 12 is being monitored, focussing on decoupling environmental impacts from economic growth, the green economy, and waste generation and management (Eurostat, 2021). However, food consumption is part of overall consumption and is not displayed separately. Hence, its link to the latter dimensions is not explicitly stated. By comparing the UN and EU indicators to achieve SDG 12, the EU has identified a set of different indicators to achieve the targets. Current indicators do not focus on food consumption. In the latest edition of the EU SDG indicators, it is mentioned that the development of an indicator on food waste is currently underway (European Commission, 2021). The European Commission has acknowledged that SDG 12 remains one of the SDGs with the lowest global scoring by its member states. It recognises that current measures are insufficient to reach this goal (European Commission, 2018).

It can be observed that EU indicators place a strong emphasis on environmental issues, while the other SFC elements are not covered or only partially (see Table 3). This indicates that the EU indicators might not be sufficient to monitor SFC based on the SDG 12 indicators. This finding is supported by Pe'er et al., who found that current indicators are insufficient and more indicators are needed to assess SDG 12 at the EU level (Pe'er et al., 2017).

3.3 | SFC reflected in other relevant SDGs

After determining that SDG 12 may not be exhaustive in assessing progression to SFC, we expanded the analysis to include other relevant SDGs based on the study by Le Blanc (2015) who showed that SDG 12 has the greatest connection to other goals (Le Blanc, 2015). However, another study found that SDG 12 has the most trade-offs with other SDGs (Pradhan et al., 2017). Pe'er et al. (2017) also stressed that the role of SDG 12 is undervalued regarding its role in achieving SDG 2. Based on the literature (Le Blanc, 2015; Rocha & Spagnuolo, 2019; Stockholm Resilience Centre, 2016), we include SDGs 1, 2, 3, 13, and 14 in our analysis due to their strong connection to SDG 12 and food. We will use EU indicators for the above-mentioned SDGs to focus on SFC in the EU policy context.

As shown in Table 4, a stronger link to the elements of SFC can be observed in SDGs 1 and 2. Since food security is less of a problem in the EU, the EU-specific SDG indicator 2.10 'Obesity rate', was selected to best illustrate the EU context. There is a negative correlation between health, SFC, and an oversupply of nutrients. However, except for 2.10, no direct link to diet or sustainable consumption choices can be observed.

Furthermore, under SDG 2, the EU currently has a specific indicator on hold that focuses on the share of animal products in the food supply. This indicator reflects the ambition of the EU F2F strategy to create a healthy food system (European Commission, 2021). However, the SDG 1 and 2 related targets are not broad enough to illustrate the more general issue of nutritious and healthy food, as described in the definition of SFC. Currently, there is no indicator

TABLE 3 EU SDG 12 indicators and their relevance to SFC.

	Elements of SFC			
Indicators	**Health**	**Economy**	**Culture**	**Environment**
12.10 Consumption of chemicals by hazardousness - EU aggregate				
12.20 Resource productivity and domestic material consumption				
12.30 Average CO_2 emissions per km from new passenger cars				
12.41 Circular material use rate				
12.50 Generation of waste excluding major mineral wastes by hazardousness				
12.61 Gross value added in environmental goods and services sector				
No link				**Positive link**

Source: Own compilation based on EU indicators (see Eurostat, 2021).

TABLE 4 Relevant to other EU SDG indicators beyond SDG 12.

SDG goal	Indicators	Elements of SFC			
		Health	Economy	Culture	Environment
1	1.10 People at risk of poverty or social exclusion		■	■	
	1.20 People at risk of income poverty after social transfers		■	■	
	1.30 Severely materially deprived people		■	■	
	1.40 People living in households with very low work intensity		■	■	
	1.41 In work at-risk-of-poverty rate		■	■	
	1.60 Population living in households with poor housing conditions	■		■	
2	2.10 Obesity rate	■			
	2.20 Agricultural factor income per annual work unit		■	■	
	2.30 Government support to agricultural research and development		■		■
	2.40 Area under organic farming				■
	2.51 Harmonised risk indicator for pesticides	■			■
	2.60 Ammonia emissions from agriculture				■
3	3.10 Healthy life years at birth	■		■	
	3.20 Share of people with good or very good perceived health	■			
	3.30 Smoking prevalence				
	3.41 Standardised death rate due to tuberculosis, HIV and hepatitis				
	3.42 Standardised avoidable mortality	■		■	
	3.60 Self-reported unmet need for medical care				
13	13.10 Greenhouse gas emissions				■
	13.20 Greenhouse gas emissions intensity of energy consumption				■
	13.30 Mean near-surface temperature deviation				■
	13.40 Climate-related economic losses				■
	13.50 Contribution to the international 100 bn USD commitment to climate related expenditure				■
	13.60 Population covered by the Covenant of Mayors for Climate and Energy signatories				■
14	14.10 Surface of marine sites designated under NAUTRA 2000				■
	14.21 Estimated trends in fish stocks exceeding fishing mortality at maximum sustainable yield				■
	14.40 Coastal bathing sites with excellent water quality				■
	14.50 Global mean ocean acidity				■
No link					**Positive link**

Source: Based on https://ec.europa.eu/eurostat/documents/276524/12239692/SDG_indicator_set_2021.pdf/ebeb73b5-9ef5-a6d8-01ea-89c4ed17b7e4?t=1610726550972.

that exclusively assesses any diet-related disease, although the high prevalence of diseases such as diabetes or coronary diseases has a link to unhealthy and often unsustainable food consumption (see Section 1).

The cultural elements of SFC are met primarily with regard to the condition of SFC being 'fair'. Other elements, such as traditions or pleasure, are not estimated in the indicators.

Focussing on the environmental aspects of SFC, we can observe a much better alignment of the key environmental elements of SFC with the targets of SDGs 2, 13, and 14.

To conclude, a broader focus on the reflection of key elements of SFC in the SDG indicators shows that, in particular, the environmental dimension is somewhat better reflected, but that there are still significant gaps in capturing all relevant dimensions of SFC.

4 | CONCLUSIONS

In this article, we evaluate whether the SDG 12 indicators are suitable to monitor progress toward a more SFC with a particular focus on the EU. Our analysis has shown that most indicators related to SDG 12 and interconnected SDGs may not be sufficient to monitor SFC based on the definitions of SFC in the literature. However, some indicators show a strong link to the elements of SFC, especially with respect to environmental and economic elements. This supports our previous observation that SDG 12 has a strong narrative on production issues, while consumption aspects, especially food consumption, have been neglected. Different definitions of SFC exist and highlight its broad spectrum. We found that the available definitions in the literature differ both in complexity and practicality. They cover dietary recommendations, environmental aspects, and economic factors. Their feasibility depends on various elements, including regional, economic, and cultural factors.

Returning to our research question, while SDG 12 is one of the SDGs with the widest scope, its indicators are difficult to link to the consumption side. We observed that the identified SDG indicator links were unevenly distributed between the SFC elements.

Looking at the EU's approach, it has linked current policies and policy initiatives to the SDGs. On SDG 12 an overall number of 925 policy initiatives have been adopted (European Commission, 2022a). With regard to agriculture, the most important EU policy is the Common Agricultural Policy (CAP). The CAP has established the framework for the European agricultural sector for the past 60 years. According to Scown et al. (2020), the links between the CAP and the SDGs are visible, but there is still significant scope for the SDGs to be integrated into the CAP (Scown et al., 2020). Looking at the key elements of SFC, the CAP is not a policy that can actively change consumption patterns.

With the introduction of the European Green Deal, the European Commission has introduced an ambitious strategy that should be central to the green transition of the EU. Based on policy documents, the Green Deal and the F2F will greatly influence the European SFC landscape if translated into adequate policies. However, the F2F strategy currently focuses only on healthy diets. The term SFC is not used. To capture all key elements that are relevant to SFC, one must connect the different strategies, as well as existing and proposed policies under the EU Green Deal on sustainable agricultural production, protection of biodiversity, and healthy diets. Here, an analysis of whether and how these are linked and adequately reflect SFC is necessary. However, this is beyond the scope of this article and is left for further research.

Although there has been a broad discussion on SFC in the EU, consumption patterns in the EU have not changed considerably (Reisch et al., 2017). Current policy measures appear to be insufficient to persuade a significant part of the population towards adopting a SFC. This seems to be the biggest point of contradiction when looking at the definition of SFC which provides relatively clear recommendations. Where is the line to what is culturally acceptable and why is it important to focus not only on scientific data, but also on values (Garnett et al., 2014). Considerable attention should also be paid to the sociology of food (Barlösius, 2016). People are sensitive to changes in consumption patterns, especially if this change is imposed through regulations. However, it seems advisable, that these elements are better reflected in future policy monitoring efforts.

Since this article aimed to capture SFC in a narrower way focusing only on consumption, other policies were not addressed. This includes production and trade policies. We acknowledge that policies focusing on sustainability cannot be seen in isolation from production or trade policies (Can et al., 2022; Costanza et al., 2016). A new integrated policy for more sustainable nutrition that holistically improves the nutrition environment could help address the challenges in the food sector and at the household level (WBAE, 2020). It must be acknowledged that there may not be one solution for SFC, but that people may weigh values differently and, therefore, assess differently what a sustainable way of life could be (Bennett et al., 2016).

Our findings may support the recent general and new EU strategy for better foresight to prepare for different crises, such as the climate crisis. The respective dashboards monitor both the status quo and the vulnerability of the economic, environmental, and political dimensions (European Commission, 2022b). However, food consumption in the proposed indicators is covered only in terms of food security. A holistic monitoring approach would integrate food consumption into the dimensions mentioned above. The respective policies reflect different political competencies and decision-making processes that should be better interlinked (Rudloff, 2020).

The findings of this article have some practical implications. It is important to exercise caution when interpreting the findings of this article since the SDG targets and the used data have been shown to have their limitations in evaluating holistic sustainable development (Kubiszewski et al., 2022; Song & Jang, 2023; Warchold et al., 2022). Current SDG indicators do not capture the key elements of SFC and can therefore not be used to measure SFC adequately. Thus, we recommend enhancing or modifying the indicators to better address the key elements. Furthermore, since a comprehensive definition of SFC does not exist, establishing a definition is crucial especially for policymakers to address all elements of SFC while designing policies. Lastly, a strong monitoring system is an important step in the design and evaluation of policies. Academic work on how to design indicators can be helpful for policymakers.

ACKNOWLEDGMENT

Open Access funding enabled and organized by Projekt DEAL.

ORCID

Kristina Mensah https://orcid.org/0000-0003-3291-1813

REFERENCES

Barlösius, E. (2016). *Soziologie des Essens: Eine sozial- und kulturwissenschaftliche Einführung in die Ernährungsforschung* (3., durchgesehene Auflage). Beltz Juventa.

Bennett, E. M., Solan, M., Biggs, R., McPhearson, T., Norström, A. V., Olsson, P., Pereira, L., Peterson, G., Raudsepp-Hearne, C., Biermann, F., Carpenter, S., Ellis, E., Hichert, T., Galaz, V., Lahsen, M., Milkoreit, M., Martín-López, B., Nicholas, K., Preiser, R., & Xu, J. (2016). Bright spots: Seeds of a good anthropocene. *Frontiers in Ecology and the Environment*, *14*(8), 441–448. https://doi.org/10.1002/fee.1309

Brundtland, G. H., & Khalid, M. (1987). *Our common future*. Oxford University Press.

Burlingame, B., & Dernini, S. (2010). *Sustainable diets and biodiversity directions and solutions for policy, research and action*. FAO Headquarters.

Can, B., Ahmed, Z., Ahmad, M., & Can, M. (2022). Do renewable energy consumption and green trade openness matter for human well-being? Empirical evidence from European Union countries. *Social Indicators Research*, *164*(3), 1043–1059. https://doi.org/10.1007/s11205-022-02981-y

Costanza, R., Fioramonti, L., & Kubiszewski, I. (2016). The UN Sustainable Development Goals and the dynamics of well-being. *Frontiers in Ecology and the Environment*, *14*(2), 59.

Crippa, M., Solazzo, E., Guizzardi, D., Monforti-Ferrario, F., Tubiello, F. N., & Leip, A. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. *Nature Food*, *2*(3), 198–209. https://doi.org/10.1038/s43016-021-00225-9

de Boer, J., & Aiking, H. (2022). Do EU consumers think about meat reduction when considering to eat a healthy, sustainable diet and to have a role in food system change? *Appetite*, *170*, 105880. https://doi.org/10.1016/j.appet.2021.105880

De Schutter, O., Jacobs, N., & Clément, C. (2020). A 'Common Food Policy' for Europe: How governance reforms can spark a shift to healthy diets and sustainable food systems. *Food Policy*, *96*, 101849. https://doi.org/10.1016/j.foodpol.2020.101849

Duchin, F. (2005). *Sustainable consumption of food a framework for analyzing scenarios about changes in diets*. http://mitpress.mit.edu/jie

European Commission. (2018). *SDSN SDG index 2018; Eurostat, sustainable development in the European Union 2018 edition. Reflection paper towards a sustainable Europe by 2030*.

European Commission. (2020). *Farm to fork strategy*. https://ec.europa.eu/food/sites/food/files/safety/docs/f2f_action-plan_2020_strategy-info_en.pdf

European Commission. (2021). *EU SDG indicator set 2021*. EUROSTAT. Retrieved from EUROSTAT website. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016DC0739&from=EN

European Commission. (2022a). *EU policies and the SDGs, Eurlex Policy Documents until 31st December 2021*. https://knowsdgs.jrc.ec.europa.eu/policies-sdgs

European Commission. (2022b). *Concepts for a sustainable EU food system: Reflections from a participatory process*. Publications Office. https://data.europa.eu/doi/10.2760/381319

Eurostat. (2021). *Sustainable development in the European Union—Monitoring report on progress towards the SDGs in an EU context*. (No. 9789276306979) https://doi.org/10.2785/195273

Fabi, C., & English, A. (2018). SDG 12.3.1: Global food loss index. In *Methodological proposal for monitoring SDG target 12.3. The global food loss index design, data collection methods and challenges* (p. 54). FAO.

Fanzo, J. (2019). Healthy and sustainable diets and food systems: The key to achieving sustainable development goal 2? *Food Ethics*, *4*(2), 159–174. https://doi.org/10.1007/s41055-019-00052-6

Fanzo, J., & Davis, C. (2021). Introduction. In J. Fanzo & C. Davis (Eds.), *Global food systems, diets, and nutrition* (pp. 1–6). Springer International Publishing. https://doi.org/10.1007/978-3-030-72763-5_1

Fanzo, J., Haddad, L., McLaren, R., Marshall, Q., Davis, C., Herforth, A., Jones, A., Beal, T., Tschirley, D., Bellows, A., Miachon, L., Gu, Y., Bloem, M., & Kapuria, A. (2020). The food systems dashboard is a new tool to inform better food policy. *Nature Food*, *1*(5), 243–246. https://doi.org/10.1038/s43016-020-0077-y

FAO. (2020). *The state of food security and nutrition in the world 2020*. FAO, IFAD, UNICEF, WFP and WHO. https://doi.org/10.4060/ca9692en

Fieldhouse, P. (1995). *Food and nutrition*. Springer US. https://doi.org/10.1007/978-1-4899-3256-3

Garnett, T., Appleby, M., Balmford, A., Bateman, I., Benton, T. G., Bloomer, P., Herrero, M. T., Hoffmann, I., Smith, P., Thornton, P. K., Toulmin, C., Vermeulin, S. J., & Fraser, D. (2014). *What is a sustainable healthy diet? A discussion paper*. https://cgspace.cgiar.org/bitstream/handle/10568/35584/FCRN-sustainable-healthy-diet.pdf?sequence=1&isAllowed=y

Gasper, D., Shah, A., & Tankha, S. (2019). The framing of sustainable consumption and production in SDG 12. *Global Policy*, *10*, 83–95. https://doi.org/10.1111/1758-5899.12592

Guyomard, H., Darcy-Vrillon, B., Esnouf, C., Marin, M., Russel, M., & Guillou, M. (2012). Eating patterns and food systems: Critical knowledge requirements for policy design and implementation. *Agriculture & Food Security*, *1*(1), 13. https://doi.org/10.1186/2048-7010-1-13

Hák, T., Moldan, B., & Dahl, A. L. (2012). *Sustainability indicators: A scientific assessment* (Vol. 67). Island Press.

Hallström, E., Carlsson-Kanyama, A., & Börjesson, P. (2015). Environmental impact of dietary change: A systematic review. *Journal of Cleaner Production*, *91*, 1–11. https://doi.org/10.1016/J.JCLEPRO.2014.12.008

Hashimzade, N. (2017). *A dictionary of economics*. Oxford University Press.

Hebinck, A., Zurek, M., Achterbosch, T., Forkman, B., Kuijsten, A., Kuiper, M., Nørrung, B., Veer, P. V., & Leip, A. (2021). A sustainability compass for policy navigation to sustainable food systems. *Global Food Security*, *29*, 100546. https://doi.org/10.1016/j.gfs.2021.100546

Herforth, A., Bellows, A. L., Marshall, Q., McLaren, R., Beal, T., Nordhagen, S., Remans, R., Estrada Carmona, N., & Fanzo, J. (2022). Diagnosing the performance of food systems to increase accountability toward healthy diets and environmental sustainability. *PLoS One*, *17*(7), e0270712. https://doi.org/10.1371/journal.pone.0270712

Herman, K. S., & Shenk, J. (2021). Pattern discovery for climate and environmental policy indicators. *Environmental Science & Policy*, *120*, 89–98. https://doi.org/10.1016/j.envsci.2021.02.003

Hopwood, B., Mellor, M., & O'Brien, G. (2005). Sustainable development: Mapping different approaches. *Sustainable Development*, *13*(1), 38–52. https://doi.org/10.1002/sd.244

Johnston, J. L., Fanzo, J. C., & Cogill, B. (2014). Understanding sustainable diets: A descriptive analysis of the determinants and processes that influence diets and their impact on health, food security, and environmental sustainability. *Advances in Nutrition*, *5*(4), 418–429. https://doi.org/10.3945/an.113.005553

Kubiszewski, I., Mulder, K., Jarvis, D., & Costanza, R. (2022). Toward better measurement of sustainable development and wellbeing: A small number of SDG indicators reliably predict life satisfaction. *Sustainable Development*, *30*(1), 139–148. https://doi.org/10.1002/sd.2234

Lang, T., & Barling, D. (2013). Nutrition and sustainability: An emerging food policy discourse. *Proceedings of the Nutrition Society*, *72*(1), 1–12. https://doi.org/10.1017/S002966511200290X

Le Blanc, D. (2015). Towards integration at last? The sustainable development goals as a network of targets. *Sustainable Development*, *23*(3), 176–187. https://doi.org/10.1002/sd.1582

Lehmann, A., Nativi, S., Mazzetti, P., Maso, J., Serral, I., Spengler, D., Niamir, A., McCallum, I., Lacroix, P., Patias, P., Rodila, D., Ray, N., & Giuliani, G. (2020). GEOEssential – Mainstreaming workflows from data sources to environment policy indicators with essential variables. *International Journal of Digital Earth*, *13*(2), 322–338. https://doi.org/10.1080/17538947.2019.1585977

Lorek, S., & Spangenberg, J. H. (2014). Sustainable consumption within a sustainable economy – Beyond green growth and green economies. *Journal of Cleaner Production*, *63*, 33–44. https://doi.org/10.1016/j.jclepro.2013.08.045

Lucas, E., Guo, M., & Guillén-Gosálbez, G. (2021). Optimising diets to reach absolute planetary environmental sustainability through consumers. *Sustainable Production and Consumption*, *28*, 877–892. https://doi.org/10.1016/j.spc.2021.07.003

Mertens, E., Veer, P. V., Hiddink, G. J., Steijns, J. M., & Kuijsten, A. (2017). Operationalising the health aspects of sustainable diets: A review. *Public Health Nutrition*, *20*(4), 739–757. https://doi.org/10.1017/S1368980016002664

Oslo Roundtable on Sustainable Production and Consumption. (1994). *The imperative of sustainable production and consumption*. https://enb.iisd.org/consume/oslo004.html

Özkaya, F., Durak, M. G., Doğan, O., Bulut, Z. A., & Haas, R. (2021). Sustainable consumption of food: Framing the concept through Turkish expert opinions. *Sustainability*, *13*(7), 3946. https://doi.org/10.3390/su13073946

Pe'er, G., Lakner, S., Passoni, G., Azam, C., Berger, J., Hartmann, L., Schüler, S., Müller, R., von Meyer-Höfer, M., & Zinngrebe, Y. (2017). *Is the CAP fit for purpose. An evidence-based, rapid fitness-check assessment*. German Centre for Integrative Biodiversity Research (IDiv) Halle-Jena-Leipzig.

Persson, Å., Weitz, N., & Nilsson, M. (2016). Follow-up and review of the sustainable development goals: Alignment vs. internalization. *Review of European, Comparative & International Environmental Law*, *25*(1), 59–68. https://doi.org/10.1111/reel.12150

Pradhan, P., Costa, L., Rybski, D., Lucht, W., & Kropp, J. P. (2017). *Earth's future a systematic study of sustainable development goal (SDG) interactions*. https://doi.org/10.1002/2017EF000632

Rayner, G., Barling, D., & Lang, T. (2008). Sustainable food systems in Europe: Policies, realities and futures. *Journal of Hunger & Environmental Nutrition*, *3*(2–3), 145–168. https://doi.org/10.1080/19320240802243209

Reisch, L., Eberle, U., & Lorek, S. (2013). Sustainable food consumption: An overview of contemporary issues and policies. *Sustainability: Science, Practice, and Policy*, *9*(2), 7–25. https://doi.org/10.1080/15487733.2013.11908111

Reisch, L., Eberle, U., & Lorek, S. (2017). *Sustainable food consumption: An overview of contemporary issues and policies*. https://doi.org/10.1080/15487733.2013.11908111

Rocha, C., & Spagnuolo, D. (2019). Sustainable and healthy diets for achieving the SDGs: The role of consumers. In R. Valentini, J. L. Sievenpiper, M. Antonelli, & K. Dembska (Eds.), *Achieving the sustainable development goals through sustainable food systems* (pp. 143–155). Springer International Publishing. https://doi.org/10.1007/978-3-030-23969-5_8

Rudloff, B. (2020). *Challenges for a coherent approach to food system resilience within the EU [MigResHub at the Migration Policy Centre]*. RSCAS, European University Institute.

Scharlemann, J. P. W., Brock, R. C., Balfour, N., Brown, C., Burgess, N. D., Guth, M. K., Ingram, D. J., Lane, R., Martin, J. G. C., Wicander, S., & Kapos, V. (2020). Towards understanding interactions between sustainable development goals: The role of environment–human linkages. *Sustainability Science*, *15*(6), 1573–1584. https://doi.org/10.1007/s11625-020-00799-6

Schebesta, H., & Candel, J. J. L. (2020). Game-changing potential of the EU's farm to fork strategy. *Nature Food*, *1*(10), 586–588. https://doi.org/10.1038/s43016-020-00166-9

Scown, M. W., Brady, M. V., & Nicholas, K. A. (2020). Billions in Misspent EU agricultural subsidies could support the sustainable development goals. *One Earth*, *3*(2), 237–250. https://doi.org/10.1016/j.oneear.2020.07.011

Scown, M. W., & Nicholas, K. A. (2020). European agricultural policy requires a stronger performance framework to achieve the sustainable development goals. *Global Sustainability*, *3*, e11. https://doi.org/10.1017/sus.2020.5

Song, J., & Jang, C. (2023). Unpacking the sustainable development goals interlinkages: A semantic network analysis of the SDGs targets. *Sustainable Development*, *sd.2547*, 2784–2796. https://doi.org/10.1002/sd.2547

Springmann, M., Clark, M., Mason-D'Croz, D., Wiebe, K., Bodirsky, B. L., Lassaletta, L., de Vries, W., Vermeulen, S. J., Herrero, M., Carlson, K. M., Jonell, M., Troell, M., DeClerck, F., Gordon, L. J., Zurayk, R., Scarborough, P., Rayner, M., Loken, B., Fanzo, J., … Willett, W. (2018). Options for keeping the food system within environmental limits. *Nature*, *562*(7728), 519–525. https://doi.org/10.1038/s41586-018-0594-0

Sterling, E. J., Pascua, P., Sigouin, A., Gazit, N., Mandle, L., Betley, E., Aini, J., Albert, S., Caillon, S., Caselle, J. E., Cheng, S. H., Claudet, J., Dacks, R., Darling, E. S., Filardi, C., Jupiter, S. D., Mawyer, A., Mejia, M., Morishige, K., … McCarter, J. (2020). Creating a space for place and multidimensional well-being: Lessons learned from localizing the SDGs. *Sustainability Science*, *15*(4), 1129–1147. https://doi.org/10.1007/s11625-020-00822-w

Stockholm Resilience Centre. (2016). *How food connects all the SDGs:Johan Rockström and Pavan Sukhdev present new way of viewing the Sustainable Development Goals and how they are all linked to food*. https://www.stockholmresilience.org/research/research-news/2016-06-14-how-food-connects-all-the-sdgs.html

UK Sustainable Development Commission. (2005). *Report for the sustainable development commission*. http://www.sd-commission.org.uk/data/files/publications/050119%20Sustainability%20implications%20of%20the%20Little%20Red%20Tractor%20scheme.pdf

UN. (2015). *Transforming our world: The 2030 agenda for sustainable development transforming our world: The 2030 agenda for sustainable development preamble*. https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf

United Nations. (2022). *Tier classification for global SDG indicators as of 04 Febuary 2022*. https://unstats.un.org/sdgs/files/Tier%20Classification%20of%20SDG%20Indicators_4%20Feb%202022_web.pdf

von Braun, J., Afsana, K., Fresco, L., Hassan, M., & Torero, M. (2021). Food systems—Definition, concept and application for the UN food systems summit. *A paper from the scientific group of the UN food systems summit*.

Warchold, A., Pradhan, P., Thapa, P., Putra, M. P. I. F., & Kropp, J. P. (2022). Building a unified sustainable development goal database: Why does sustainable development goal data selection matter? *Sustainable Development*, *30*(5), 1278–1293. https://doi.org/10.1002/sd.2316

WBAE. (2020). *Promoting sustainability in food consumption—Developing an integrated food policy and creating fair food environments* [Expertise]. Berlin. https://www.bmel.de/DE/Ministerium/Organisation/Beiraete/_Texte/AgrVeroeffentlichungen.html

Weitz, N., Carlsen, H., Nilsson, M., & Skånberg, K. (2018). Towards systemic and contextual priority setting for implementing the 2030 agenda. *Sustainability Science*, *13*(2), 531–548. https://doi.org/10.1007/s11625-017-0470-0

WHO. (2018). *Fact sheet noncommunicable diseases*. https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

Wieck, C., Hausmann, I., Wieck, C., & Hausmann, I. (2019). *Indicators everywhere: The new accountability of agricultural policy?* https://doi.org/10.22004/AG.ECON.289722

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., De Clerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., … Murray, C. J. L. (2019). Food in the anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, *393*(10170), 447–492. https://doi.org/10.1016/S0140-6736(18)31788-4

Wilson, N., Cleghorn, C. L., Cobiac, L. J., Mizdrak, A., & Nghiem, N. (2019). Achieving healthy and sustainable diets: A review of the results of recent mathematical optimization studies. *Advances in Nutrition*, *10*-(Supplement_4), S389–S403. https://doi.org/10.1093/advances/nmz037

World Health Organization. (2019). *Sustainable healthy diets: Guiding principles*. Food & Agriculture Org.

Xue, L., Liu, G., Parfitt, J., Liu, X., Van Herpen, E., Stenmarck, Å., O'Connor, C., Östergren, K., & Cheng, S. (2017). Missing food, missing data? A critical review of global food losses and food waste data. *Environmental Science & Technology*, *51*(12), 6618–6633. https://doi.org/10.1021/acs.est.7b00401

How to cite this article: Mensah, K., Wieck, C., & Rudloff, B. (2024). Sustainable food consumption and Sustainable Development Goal 12: Conceptual challenges for monitoring and implementation. *Sustainable Development*, *32*(1), 1109–1119. https://doi.org/10.1002/sd.2718