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UNDERSTANDING, DEFINING AND ASSESSING FOOD SYSTEMS' SOCIAL AND ECONOMIC SUSTAINABILITY INDICATORS: IMPLEMENTATION OF MIXED METHODOLOGIES FOR POLICY INSIGHTS

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Abstract

Sustainability encompasses the presence of three dimensions that must coexist simultaneously, namely the environmental, social, and economic ones. Despite the general effort that has been made since the first definition of sustainable development, that has at its core the concept of sustainability, the environmental dimension has easily got the spotlight in the decades following the publication of the Brundtland report in 1987 *Our Common Future*. This might be driven by the major availability of tools and indicators to assess and measure products and processes' impacts on the environment. Despite this, the economic and social dimensions are gaining again the spotlight in recent years, especially within food systems thanks to a renewed interest of society on how to improve the overall sustainability of said systems. In order to assess social and economic impacts, positive or negative, indicators and tools play a fundamental role in contributing to the achievements of sustainability targets, such as the one proposed by the UN within the Agenda2030. Although an increasing interest on these topics by the research community has boosted the production of scientific literature, few of them have deepen the focus on social and economic impacts in the food systems. Moreover, in a framework of citizen science and bottom-up approach for improving food systems, citizen play a key role in defying their priorities in terms of social and economic interventions. The scope of this research is to expand the knowledge of social and economic sustainability indicators within the food systems for robust policy insights and interventions. More specifically, this work was intended to accomplish the following objectives: 1) to define social and economic indicators within the supply chain with a stakeholder perspective, 2) to test social and economic sustainability indicators for future food systems engaging young generations. The first objective was accomplished through the development of a systematic literature review based on the PRISMA guidelines. The selection criteria resulted in 101 papers and gray literature documents published from 2000 to 2021. Thirty-four social sustainability tools are analyzed based on five food supply chain stages, namely production, processing, wholesale, retail, and consumer and four stakeholders as adapted from the most recent Social Life Cycle Assessment guidelines, namely farmers, workers, consumers, and society. The second objective was achieved by defining and test new food systems social and economic sustainability indicators through youth engagement for informed and robust policy insights, to provide policymakers suggestions that would incorporate citizen's needs, specifically young generations ones. A literature review was conducted to define the most probable future food systems scenarios. These are then evaluated by youth through focus groups, whose results are analyzed in NVivo and then translated into a survey to confirm the results with a wider platform. Overall conclusion addressed the main areas of policy interventions in terms of social and economic aspects of sustainable food systems that youth pointed out as in need of an interventions namely spanning from food labelling reporting sustainable origin of raw products to better access to online food services. Several areas of interventions that could increase the environmental, social, and economic sustainability future food systems were proposed, confirming the importance bringing within the dialogue towards future society development stakeholders, such as youth that are rarely considered.

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Introduction

New approaches to food systems sustainability

Many elements drive the increasing population trend, which started after the end of the Second World War, initially thanks to the advancements in the fields of nitrogen fertilizers which increased tenfold crops yields, and in the decades later through a general improvement of worldwide living conditions and general peace (Fields 2004). Population increase means more resources to be consumed to sustain its growing needs, which is consequently a burden in terms of resources consumed, widening at the same time the inequalities in terms of access to these resources, which would be sufficient in terms of population if properly managed (Ganivet 2019). The environmental footprint of mankind varies from country to country, but in general, each year the Earth Overshoot day, that's to say the day in which humanity's demand for ecological resources and services in a given year exceeds what Earth can regenerate in that year, comes earlier (Global Footprint Network 2021). Environmental misuse of resources tend to create an unbalance from a social and economic point of view in society. To amend this situation, the most recent the Agenda 2030 and Sustainable Development Goals, have been released to reduce society impacts on the world, while at the same time promoting environmental, social and economic sustainability (UN 2015). In terms of environmental impact, food production accounts for over a quarter (26%) of global greenhouse gas emissions, since half of the world's habitable (ice- and desert-free) land is used for agriculture and 70% of global freshwater withdrawals are used for agriculture (Poore and Nemecek 2018). Several measures exist to reduce these impacts, as environmental damages seem easier to measure. Nevertheless, the full sustainability of these systems can only be achieved when only the economic and the social one is achieved too (Littig and Grießler 2005). The renewed interest in these two dimensions might be linked to the development of recent sustainable development theories, such as Raworth Doughnut Economics theory, that have combined the concept of planetary boundaries (Biermann and Kim 2020) to human expansion with the complementary concept of social and economic boundaries (Raworth 2017). The theory claims that only guaranteeing certain social foundations such as food security, health, education, social equity, gender equality and political voice, a safe and just space for humanity can be built. Eizenberg and Jabareen propose instead a comprehensive Conceptual Framework of Social Sustainability based on equity, safety, eco presumption and urban forms (Eizenberg and Jabareen 2017a). As concerned economic sustainability, a new paradigm of development is required from society in terms of sustainable development, one that can shape markets through an improvement of corporate business models, reorientating and mobilizing financial systems and an enabling environment that promotes regulation and incentivizes actions (Klitgaard 2020). Since economic sustainability refers to practices that support long-term economic growth without negatively impacting social, environmental, and cultural aspects of the community, it is strictly embedded to social sustainability. Despite being theoretically aiming at the same purpose, that's to say achieving sustainable development, these two notions, social and economic sustainability are not always compatible, since economic gains may mean equity loss or social benefits may cause economic losses (Du and Zhang 2020). In general,

these two pillars of sustainability have not often been explored in a deep way due to their complexity and only in recent years they have gained the spotlight. In general, most studies in the field of sustainability and its application to food systems, have mainly focused on stakeholders' single perspectives, such as farmers, mainly investigated by rural sociologists, or private companies, which in general release reports on their socio-economic impacts. Few literatures exist on the whole supply chain. Such approaches, however, have failed to address the complexity of food systems in terms of stakeholders' relationships. In general, the complexity of food systems as living ecosystems made of different stakeholders who build relationships amongst themselves and influenced by internal (population growth, urbanization) and external drivers (climate change) (Von Braun et al. 2020).

Measuring social and economic impacts within the food supply chain

Many worldwide governments, international organization and non-governmental organizations' agendas for the future relies on the utilization of indicators and tools to measure the real advancements on their objectives (Waas et al. 2014). Sustainable Development Goals rely for example on hundreds of them to measure the improvement of specific target areas (SDG Indicators 2020). Indicators, within tools, are intended as specific, observable, and measurable characteristics that can be used to show a changes or progress towards a specific outcome (Moldan, Janoušková, and Hák 2012). At the same time, tools gather a series of methodologies, frameworks, software, policies. Evaluation tools receive inputs of different sort and once applied, release outputs that can be helpful in assessing and measuring a specific aspects of phenomena of sustainability (Gil and Duarte 2010; Olivier, Flour, and Bokhoree 2021). Amongst the most common used sustainability evaluation methodologies, the ones belonging to Life Cycle Thinking approach involve looking at life cycle-generated impacts and ways to minimize these impacts(Luján-Ornelas et al. 2020) . An important component to life cycle approaches is avoiding burden shifting, in other words, ensuring that improvements in one stage are not achieved at the expense of another stage (Life Cycle Initiative 2022). Within this approach commonly used methodologies are Life Cycle Assessment, used to assess potential environmental impacts, Life Cycle Costing, which aims at optimizing cost effectiveness, and Social Life Cycle Assessment, which measure both positive and negative social impacts of a process. Integrating these methodologies with qualitative aspects such as focus groups, surveys, and foresight exercise, can be meaningful in capturing those nuances these methodologies often ignore. The utilization of tools depends on the typology of product or process to be analyzed, and mostly important the stakeholders involved. Certain companies for example utilize Global Reporting Initiatives (GRI) schemes to build their sustainability reports, other certifications like the FairTrade, others analytical tools like Social Impact Assessment, Health Impact Assessment. Other tools consist in guidelines released by intergovernmental organizations such as the United Nations, like the "Sustainability Assessment of Food and Agriculture guidelines (FAO 2014). The increasing interest towards fostering more just, equal, and healthy food systems by society, has propelled to the recent forefront in investigations of social and economic sustainability within them, specifically in how stakeholders that compose supply chains are influenced by productions.

Food supply chains and the role of citizens

Food supply chains are generally intended as a series of steps that comprises all the stages that food products go through, namely: production, transformation, wholesale, retail, distribution that reach the ultimate final consumer. Consequently, stakeholders as farmers, workers, wholesaler, retailer are interlinked by interactions. Most of the literature regarding social and economic impacts generally considers single stages, mostly farmers (Binder, Feola, and Steinberger 2010; Marchand et al. 2014; De Olde et al. 2016; de Olde et al. 2017). Companies on the contrary tend to focus on the last steps of the supply chain and the role of consumers. Few works have taken into consideration how social and economic sustainability can be measured within the whole supply chain, despite being imperative to have a continuous thread of it along the whole supply chain. Nevertheless, it is clear that consumers have an extreme influence power when it comes to influence what happen uphill the chain (Hingley et al. 2013). A shift in preferences, principles, virtues, beliefs, can change purchase patters (K. White, Habib, and Hardisty 2019). As the attention from consumers towards social and economic sustainability has risen, it is fundamental to include them, following a bottom-up approach, within policy mechanism. Within a bottom-up approach for policy making, citizen engagement could represent a social feedback system to provide insight for policy makers (Nascimento et al. 2016). Democratic countries have a long story of operationalizing citizen engagement through public hearings, citizen polls and other consultative methods (Woodford and Preston 2013). Citizen's participation is considered a cornerstone in modern democracy and is critical to active citizenship. It is said to offer many benefits, including a means to reverse the growing democratic deficit, foster citizen and community capacity, and promote responsive and effective policy decisions (Nascimento et al. 2016). At the same time, young generations are the ones that will live through these policies, and in order for these be effective, the policy making cycle should include their perspectives on what they believe to priorities in terms of social and economic sustainability. Including these elements would make policies more effective and acceptable.

Objectives of this research

The aim of this research is to contribute to the understanding and development of existing and new social and economic sustainability indicators for food supply chains, with a particular focus on how young generations perceive future food systems, and possible interventions on them, for robust policies insights. Altogether the work aimed to define social tools and indicators for the whole supply chain within the perspective of stakeholders, and subsequently, address the major gaps in terms of social and economic sustainability for young people, to obtain robust policies insights:

1) understand the current state of social sustainability indicators and tools within the food supply chain considering the stakeholders involved:
    - by investigating the current state of the indicators based on the type of document, funding, origin

- by defining trends in the use of indicators and tools
- by understanding possible lacks in terms of indicators and tools availability depending on the stakeholders

2) define and test new and current social and economic indicators for future food systems for robust policies insight:
    - by defining a future food systems matrix through a literature review
    - by understanding through focus groups with young people what challenges said scenarios would have brought forth in the future, and obtaining indicators
    - by testing through a survey, the results of the focus groups with a wider audience to define new social and economic sustainability indicators

Thesis structure

The work consists of two chapters covering a systematic literature review in the first one and a qualitative analysis in the second one.

Chapter 1 introduced the general foundations of the work that will be furtherly developed within Chapter 2. In **Chapter 1**, a systematic literature review is performed on social sustainability indicators adopting PRISMA guidelines. The study aimed at assessing and identify the current state of art of how social sustainability aspects are measured through various tools and indicators. Thirty-four social sustainability tools are analyzed based on five food supply chain stages, namely production, processing, wholesale, retail, and consumer and four stakeholders as adapted from the most recent Social Life Cycle Assessment guidelines, namely farmers, workers, consumers, and society. Production and processing- related assessment tools are mostly publicly funded, while wholesale, retail, and consumer tools are often privately funded. Moreover, the availability of assessment tools decreases along the supply chain. Production has the highest number of tools (17) and quantitative indicators, targeting mostly farmers through job conditions and quality of life indicators. Processing stage tools (5) target mostly workers, through quantitative indicators related to fair job conditions. The wholesaler stage tools (4) and indicators are the least connected, while the retail stage (2) is the most inclusive in terms of qualitative social sustain- ability indicators. The consumer stage tools (2) also has a low number of social indicators and interactions, despite being the stage that influences the supply chain the most. Food supply chain stakeholders can benefit from the implementation of social sustainability aspects, although these benefits become inconsistent if not respected in each stage. A need for an unceasing thread of respected social sustainability should permeate the whole supply chain, as environmental certification currently does, be- coming the priority for policy makers in the sector to focus their attention on the emerged hotspots for intervention from this research. In **Chapter 2**, define and test new food systems social sustainability indicators through youth engagement for informed and robust policy insights, to provide policymakers suggestions that would incorporate citizen's needs, specifically young generations ones. A literature review is conducted to

define the most probable future food systems scenarios. These are then evaluated by youth through focus groups, whose results are analyzed in NVivo and then translated into a survey to confirm the results with a wider platform. Four scenarios result from the literature review, namely 1) Elitarian Society, 2) Inclusive and environmentally friendly society, 3) Consumerist closed-up society, and 4) Society 2021.Twenty-eight sustainability thematic areas emerged from the focus groups discussion on them, which led to the identification of 31 new food system indicators, 20 of them on social aspects. Indicators were then inserted within survey questions to be evaluated by a convenience sample of 524 respondents, belonging for 50% to Generation Z (born between 1997-2012). On a policy perspective respondents require an intervention on gaining access to farmers market, promoting food education courses and increase the certifications that guarantee the sustainability of products. Most of them moreover were not satisfied in terms of food waste management from their municipalities.

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CHAPTER 1- Social sustainability tools and indicators for the food supply chain: a systematic literature review

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Abstract

Sustainable production and consumption of food systems cannot be achieved without considering the entirety of the supply chain and the actors involved at each stage along the way. This requires more in-depth analyses of social dimensions often neglected in favor of the environmental and economic ones. Yet, inattention to the social dimension of sustainability in food supply chains has yielded a lack of agreement regarding what to consider and how to measure it. This review identifies the current state of art of how social sustainability aspects are measured through various tools and indicators, following the "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA) protocol. The selection criteria resulted in 101 papers and grey literature documents published from 2000 to 2021. Thirty-four social sustainability tools are analyzed based on five food supply chain stages, namely production, processing, wholesale, retail, and consumer and four stakeholders as adapted from the most recent Social Life Cycle Assessment guidelines, namely farmers, workers, consumers, and society. Production and processing-related assessment tools are mostly publicly funded, while wholesale, retail, and consumer tools are often privately funded. Moreover, the availability of assessment tools decreases along the supply chain. Production has the highest number of tools (17) and quantitative indicators, targeting mostly farmers through job conditions and quality of life indicators. Processing stage tools (5) target mostly workers, through quantitative indicators related to fair job conditions. The wholesaler stage tools (4) and indicators are the least connected, while the retail stage (2) is the most inclusive in terms of qualitative social sustainability indicators. The consumer stage tools (2) also has a low number of social indicators and interactions, despite being the stage that influences the supply chain the most. It is clear that food supply chain stakeholders can benefit from the implementation of social sustainability aspects, although these benefits become inconsistent if not respected in each stage. A need for an unceasing thread of respected social sustainability should permeate the whole supply chain, as environmental certification currently does, becoming the priority for policy makers in the sector to focus their attention on the emerged hotspots for intervention from this research.

1 Introduction

Sustainability is a moving target, dependent upon the stakeholders who define it. As such, assessment methodologies and tools vary in purpose and scope making it harder to measure and achieve. Nowhere is this of fundamental importance than human food systems that constitute the basis of human wellbeing and development. To understand paths towards sustainability, food supply chains are a necessary site of inquiry and action.

The European Union (EU) is actively seeking policy approaches that advance economically, environmentally, and socially sustainable supply chains. With the European Green Deal, this attention includes an emphasis on the social pillar of sustainability (EC 2019). Instrumentalizing the social pillar requires further elaborations of social dimensions and improving how tools measure these aspects. Tools are intended as policy instruments, software, frameworks, methodologies that use indicators to measure sustainability. Specifically, sustainability assessments that address a specific dimension of sustainability, are intended for a user, can be applied to a specific stage or level of the process considered, have a purpose, and a specificity level (Schader et al. 2014; De Olde et al. 2016). Indicators, within tools, are intended as specific, observable, and measurable characteristics that can be used to show a changes or progress towards a specific outcome (Moldan et al. 2012).

The EU effort to define sustainability indicators and the achievement of more sustainable food systems aligns with the 17 Sustainable Development Goals (SDGs) proposed by the Agenda 2030, specifically number 2 Zero hunger, 5 Gender equality, 8 Decent work and economic growth, 10 Reduced inequalities and 12 Responsible consumption and production (UN 2015). Social sustainability is at the heart of the youth dialogue regarding the future development of society, since, as remarked during the 2021 Youth4Climate and Y20 events, no sustainable future can be achieved without social equity (Youth4Climate 2021; Y20 2021).

The first awareness society had towards the need of sustainability dates to the mid-20th century. Starting from the 1960s, environmental movements brought attention to environmental costs associated with the many material benefits that were now being enjoyed, brought by the post war economic development. These movements eventually grew from 1970 to 1980 due to a lack of environmental global development (Caldwell 1984; Callicott and Mumford 1997). This resulted in desires to shift global development towards choices that prioritize safeguarding the environment. In 1987, the first World Commission on Environment and Development delivered the Brundtland report, the first official document published from the United Nations whose targets were multilateralism and interdependence of nations in the search for a sustainable development path (WCED, 1987). From its first mention on the Brundtland report, the concept of sustainability has pervaded the world, and society, whatever choice makes, must abide to it. The general trend that has settled from the first publication of the Brundtland report is a particular attention, from society to the environmental aspect of sustainability (Purvis, Mao, and Robinson 2019).

Other dimensions of sustainability, such as the economic and the social, but particularly the latter, have often been left aside (Eizenberg and Jabareen 2017). This could probably be due to several reasons. Some authors

have argued that the social dimension is an open and arguable concept (Boström 2012) and theoretically difficult to understand, since its very meaning is often linked to values that are not universal. The complexity of social sustainability can be perceived by the definition of the term itself, since there is not a common and shared understanding of what socially sustainable means (Missimer et al. 2017). Social sustainability is often dependent on the context or the source of the information. The social dimension is key to the concept of sustainability, since for the latter to be achieved, it implies the imperative of human wellbeing today and in future (Janker 2020). The difficulty of social sustainability to be universally measured has resulted in omitting this dimension from public debate and political consciousness (Kelley and Simmons 2015). nevertheless, consensus within the scientific community shows social sustainability focuses on personal assets like education, skills, experience, consumption, income, and employment (Omann and Spangenberg 2012). Based on the number of publications of the last decade, most of them are dedicated to environmental sustainability, secondly to the economic one, and lastly the social sustainability. Economic and social aspects are sometimes relevant in this approach insofar as the ecologization of social development needs to be economically and socially compatible as well (Dahl 2012).

Agricultural systems can be defined as complex social-ecological system (SES), composed of several subsystems and internal variables (Ostrom 2009). Each sub-element is separate and independent from the other but strictly linked at the same time, often in a hierarchical structure. To explain how different single elements compose the agricultural system, a bottom-up thread could be: crops feed the farmer, farmers organize in association, and different associations define an agricultural system. Several studies have deeply analyzed the impacts of agricultural and food production activities from an environmental, economic, and social perspective, often targeting a single group of stakeholders or a single stage of the supply chain (Marchand et al. 2014; De Olde et al. 2016). Nonetheless, a deep focus on the social dimension and the impact on stakeholders interaction within the whole supply chain is missing (Nadaraja et al. 2021).

The rationale behind this study and the need of this systematic review lies in the proposition that food supply chains will never be completely defined as sustainable if social costs are excluded from the equation and defined as externalities (Adams et al. 2021). Thus, there is a need to determine which tools and indicators best address these social factors. Departing from previous studies, this paper adopts a supply chain-oriented approach. The research questions addressed in the review aim at (1) assessing how the scientific literature on social sustainability regarding food supply chains has evolved in recent years, (2) identifying the established and proposed tools used to assess it, and (3) delineating the main indicators that can contribute to achieve this aim.

The paper is organized as follows: section two reviews the literature on assessing social sustainability; section three explains the methodology adopted to guide the systematic literature review; section four reports the results; section five discusses the findings in context of existing research and future directions, followed by section six, the conclusion.

2 Literature review

2.1 Assessing Social Sustainability

Evolving conceptualizations and institutionalizations of sustainability strive toward a balancing of interrelated environment, society, and economy domains (Malakar and Lu 2021). In the decades since the Brundtland report (WCED 1987), the novelty of an emphasis on the environment in development decisions has waned and led to critiques of sustainable development as overly focused on environmentally policies, strategies, and measures (Littig and Grießler 2005). Many have argued for more balanced applications of sustainability (Murphy 2012; Hicks et al. 2016) yet operationalizing the axiological aims of sustainability in the food systems where natural-resource dependent processes require profitability, calls for the maturation of notions of social sustainability (FAO 2018).

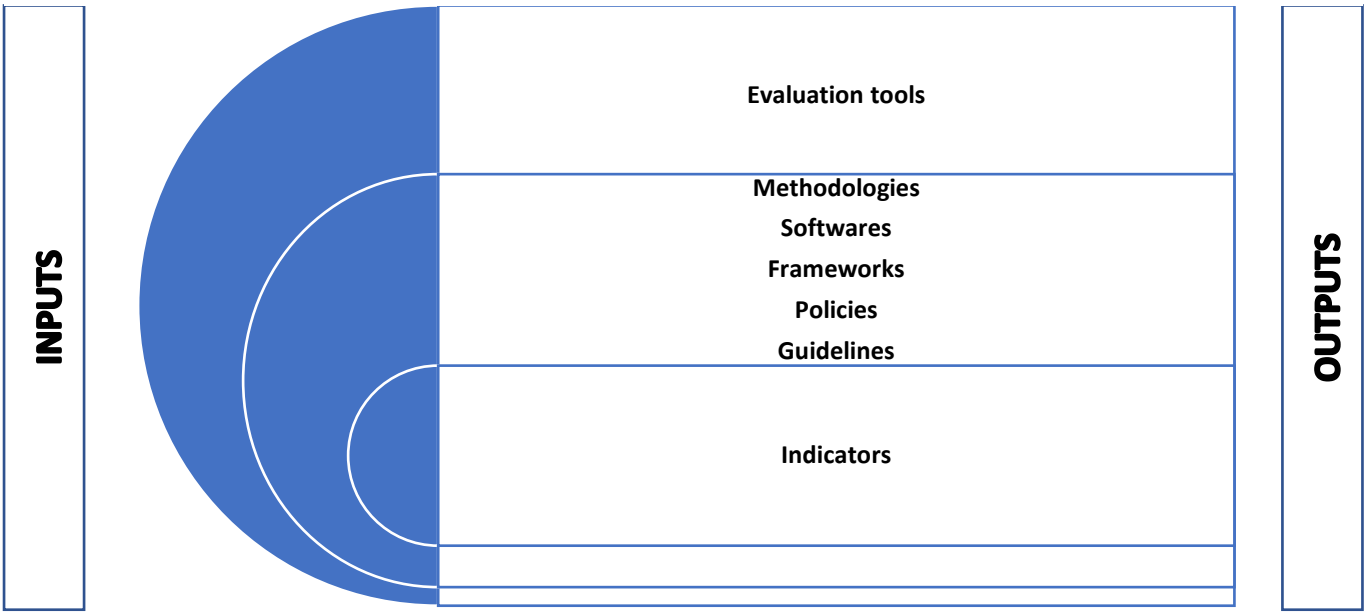
The complexity of interactions among diverse stakeholders' thwarts efforts to measure social impacts. Agriculture, is recognized as the most volatile activity in the primary economic sector, due to its dependence on uncertain weather conditions and erratic commodity prices that impede predictions of next year's harvest (Muflikh et al. 2021). Moreover, critical parts of the food supply chain are becoming more capital-oriented, vertically integrated, and controlled by a few corporations (Folke et al. 2019) resulting in the shaping of the food supply chain as an hourglass, where critical passages are subdued to the interests of a few (Cervantes-Godoy et al. 2014).

Despite increased integration of the social dimension into food supply chain research, the creation of a general framework useful to understand social sustainability lacks coherence (Hicks et al. 2016; Eizenberg and Jabareen 2017). The social bottom-line has traditionally been related to values of equity, solidarity, fairness, and social justice among human beings, which should be guaranteed intergenerationally and intragenerationally (Summers and Smith 2014). Some still claim that scholars overemphasize environmental sustainability (Opp 2017; Moser and Baulcomb 2020) questioning whether the economic and social aspects of agricultural and food sustainability only matter when interpreted through an environmental perspective. Others argue these two dimensions are independent and self-sufficient in the food supply chain (Littig and Grießler 2005).

The comparative underdevelopment of the social bottom-line may be linked to its evasiveness of objective measurements (Toussaint et al. 2021) compared to more empirical phenomena such as atmospheric CO_2 level. Others suggest that dependence of social metrics on disclosures and transparency from companies impedes measurement (Munteanu et al. 2020; Gazzola et al. 2020). In 2009, the United Nations Environment Program's Society of Environmental Toxicology and Chemistry (SETAC) developed guidelines for performing social life cycle assessment defining what 'social' in terms of positive or negative impacts on society caused by a product production or productive processes. Later in the years, what is "socially sustainable" was conceived as a threefold schema (Vallance et al. 2011): (1) *development sustainability* addressing basic needs with the

final aim of creating equity and social capital, (2) *bridge sustainability* directly linked to the environmental one where the achievement of biophysical environmental goals, and (3) *maintenance sustainability* aimed at preserving sociocultural values against changes. Vallance clarified how the social dimension is intrinsically bonded to the others—as the only way to pursue development is to the consider the bridge to the biophysical goals: human needs are fundamentally linked to environment and vice versa in the human perspective. In fact, these concepts were also pivot of the UN's 17 Sustainable Development Goals (SDG) and indicators, as human wellbeing is the centerpiece of social sustainability and is reflected especially within the following ones: good health and wellbeing (SDG3), gender equality (SDG5), economic growth (SDG8), inequalities (SDG10). These goals that promote the achievement of different social aspects can be directly linked to the food supply chain. However, achieving these goals can only be possible through the assessment and measurements of sustainability aspects through evaluation tools. The evaluation tool's structure that was followed throughout the paper (figure 1), was adjusted following the teachings of Binder et al. 2010, Schader et al. 2014, and De Olde et al 2017, who made a first attempt to frame sustainability tools within the supply chains. Methodologies, frameworks, softwares, policies are gathered under this term. Evaluation tools received inputs of different sort and once applied, release outputs that can be helpful in assessing and measuring a specific aspects of phenomena of sustainability (OECD 2007).

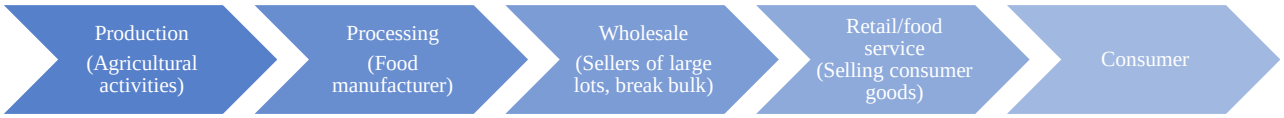
Figure 1 Evaluation tools structure, derived from OECD and De Olde et al. 2017



2.2 Social sustainability and food supply chains

In the agricultural sector, social sustainability is commonly investigated and measured along the food supply chain (FSC) (Malak-Rawlikowska et al. 2019). Different representations of the FSC exist, yet scholarly and institutional consensus identifies five key stages: production, processing, wholesale, retailer/food services, and consumer (figure 2) (Eurostat 2011; Albrecht et al. 2013).

Figure 2 The food supply chain stages



Social sustainability could be understood when considering food systems as food supply chains, where each stage, defined as a phase in which the food product is transformed, is analyzed by focusing on the stakeholder involved.

FSC entail a range of different actors each connected through value-adding activities involved in the production, aggregation, processing, distribution, consumption, and disposal of food products, originated from agriculture, forestry, or fisheries activities. FSC stakeholders interact and influence each other and the broader natural, economic, and social environments in where they operate (FAO 2018). Since social sustainability permeates each stage of the chain—due to the human involvement of farmers, workers, and consumers—society has increasingly gained awareness on the social concerns arising on public health, workers welfare, and animal wellbeing within these (Bos et al. 2009).

Several authors (Hayati et al. 2010; De Olde et al. 2016) have analyzed social sustainability in specific stages of the supply chain. The UNEP SETAC guidelines for Social Life Cycle Assessment (SLCA) assesses positive and negative impacts of a product or process via five stakeholder categories: workers, local community, society, consumers, and value chain actors (UNEP 2009; UNEP 2020).

Many authors analyze social sustainability within a single supply chain stage focusing on one stakeholder, without taking into consideration existing relationships with others (D'Eusanio et al. 2019; Mani et al. 2020). For each stage of the supply chain, the following social impacts are involved and linked: social learning among farmers, rural communities' development and autonomy, consumers participation, housing issues, food waste and related impacts, urban studies, and consumers studies (De Menna et al. 2016; Vittuari et al. 2016). Food waste is a key topic that permeates the whole supply chain, as food losses and food wastes belong to all the stages. Food waste carries a significant social value due to the impact of economic losses and the waste of resources.

2.2.1 Supply Chain

Starting from the *production* stage, De Olde (De Olde et al. 2016) listed 48 tools, identified through the application of a comparative framework, that could measure, for different productive sites whether social sustainability was respected or not. Tools reported were specific for certain agricultural productions, like poultry and tobacco, and the social sustainability concept varied from tool to tool depending on the authors' perceptions of socially sustainable.

From the research led by Janker (2019), a systems approach applied to the social sustainability of agricultural systems emphasized the complexity of social systems as part of the agricultural system, then the wider societal system goes beyond the farm, as relationships expand beyond farms' geographical boundaries. Bostrom (2012) argued that social sustainability in agriculture should entail equality of rights, access to infrastructure, community capacity for the development of civil society, and improved workers health and social cohesion. Although promising statements, the presence of one of these indicators does not always mean an upsurge in social sustainability. In fact Mancini (2008) demonstrated through a case study in the Indian region of Andhra Pradesh that an increase in women's employment rate was linked to extra work for women, since home duties and family care activities were not equally divided between husbands and wives. Shreck (2006) disputed that to empower farmworkers and to create production conditions that are favorable to a broader conception of social justice, a change must occur simultaneously along the whole supply chain, and not only in the first stages.

Processing, the second stage of the supply chain, is gaining a significant amount of attention from a social perspective, since the survival of plants and animals, and workers' general welfare depend on best practices pursued by food companies (Woodhouse et al. 2018). In this industry, two main categories are studied: animals and workers welfare. Workers' welfare has been particularly considered in the wine sector where social impacts on workers and their wellbeing were analyzed. Researchers have highlighted how this specific business-driven sector is attempting to improve practices in light of increased consumer attention to social sustainability practices (Recchia et al. 2019; Lago et al. 2020).

The wine industry has witnessed an increase in social sustainability fostering practices: through a case study on wine, Pullman (2010) indicated that these practices such as workplace opportunity, human resources policies, quality of life, governance, and democratic processes could improve workers' social conditions. The wine company of Pullman's case study was demonstrated to bring benefits on society at large through local purchases, local hiring, support to local community events, and enhanced worker safety programs. These positive externalities private where confirmed by Xu et al. (2020), who measured effects of wine tourism incomes on the surrounding areas.

Aiming at enhancing social sustainability, private businesses are adopting self-regulations called corporate social responsibility (CSR) (Sheehy 2014) that aim to make the business socially accountable to its workers, stakeholders, and to the public (De Luca et al. 2017).

Maloni and Brown (2006) investigated the application of CSR to the food industry, developing a framework which includes animal welfare, biotechnology development, fair trade, health and safety, labor and human rights. The authors concluded that food companies are in general prime targets for public concern over perceived social sustainability deficiencies meaning that an increased standardization for these practices could improve social sustainability on many levels.

Wholesalers and retailers adopted CSR too. Hsu, Tan, and Mohamad Zailani (2016) argued that customer opinions are an important motivator driving retailers to adopt socially responsible approaches. One study of

British food retailers showed consumers' desires clustered around the themes of organic and fair-trade products, healthy living ranges, local production, and community issues (Jones 2007). CSR is also an important element of reputation management, as the study of Chkanikova (2015) showed how consumer opinions in the form of food scares (Bovine Spongiform Encephalopathy, "Mad Cow Disease") and product boycotts are important driver for retailer to address social sustainability issues. Moreover, CSR played an important role in reassuring consumers on issues related to the social sustainability of certain palm oils origin, correlated with deforestation issues in South America (Verneau et al. 2019). In general, a large number of firms believe that the social dimension is an important part of intern processes of circular economy, although rarely social assessment are conducted (Walker et al. 2021).

For what concerns social sustainability and *consumers*, this dimension of sustainability is not directly related to buyers themselves, but rather on how social sustainability is perceived (Vermeir 2004). In this study, social sustainability is embedded in consumer choice and consumption of products that, through specific certifications, although often provided by the retailer itself as "promises of quality" regarding animal welfare and fair trade. Literature suggests that the socially sustainable consumer is an ethical consumer. Instead of considering the social sustainability downhill from consumers choices, Robinson (2002) utilized an uphill consumer profiling, where psychology plays a role in influencing consumer choices: psychosocial values are those variables like attitude, beliefs, perceived acts of behavioral control that can influence people while buying. Under this perspective the social sustainability, a product is directly linked to the feelings that the products itself triggers within the final customer.

A recent study from D'Eusanio et al. (2019) describes that the key for achieving an acceptable level of sustainability along any supply chain lies in an integrative approach that considers this dimension on all stages. Bubicz at al. (2019) confirm how the holistic view of the supply chain is necessary when targeting sustainability.

3 Methodology

This study applies a systematic literature research, adopting a replicable process performed according to standards set by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al. 2009), being an established and robust method for conducting such analysis (Tam et al. 2017; Page et al. 2021). The review schematically and structurally followed leading literature reviews in the field by Binder, Feola, and Steinberger 2010; Gasparatos and Scolobig 2012; Binder et al. 2013; Schader et al. 2014; Marchand et al. 2014; De Olde et al. 2016; Kühnen and Hahn 2017; Janker, Mann, and Rist 2019; Janker 2020 , authors that have firstly attempted to create assessments frameworks for social sustainability aspects. The methodology was developed around three phases: material collection and eligibility criteria for peer reviewed documents and grey literature, descriptive analysis, and data analysis and risks of bias.

3.1 Material collection and eligibility criteria for peer reviewed documents

Material collection involved all the steps that brought to the collection of the material to be analyzed. Scopus database and Web of Science database were chosen to guarantee a comprehensive research, since they gather thousands of peer reviewed journals from a wide range of subjects fields, allowing the access to multidisciplinary publications and citations (Scopus.com; Clarivate.com). Databases were searched using a range of key words related to the objective of the research: sustainability, social sustainability, agriculture, food systems, food supply chain, tools, indicators. The presence of these keywords was searched in the title, abstract and keyword of the materials. The operator AND was included in the query to guarantee the presence in the documents of all the keywords. The following query strings analyzed where used in the databases (Table 1).

Table 1 Query strings and document results

Query strings
TITLE-ABS-KEY (Social sustainability AND agriculture AND tools)
TITLE-ABS-KEY (Social sustainability AND food systems AND tools)
TITLE-ABS-KEY (Social sustainability AND agriculture AND indicators)
TITLE-ABS-KEY (Social sustainability AND food systems AND indicators)
TITLE-ABS-KEY (Social sustainability AND food supply chain AND tools)
TITLE-ABS-KEY (Social sustainability AND food supply chain AND indicators)

Peer-reviewed studies included cover a time span ranging from 2000 to 2020. This date range was selected because it covers increased attention that society had in the early 2000 towards social sustainability issues; thanks to the 2009 UNEP/SETAC guidelines for Social Life Cycle Assessment (SLCA), a milestone in the development of social sustainability assessment tools in the following years, which have been updated in 2020. The search of the two databases resulted in 4383 documents, to which inclusion/exclusion criteria (Table 2) were applied for a further refine.

Table 2 Inclusion/exclusion criteria for database search

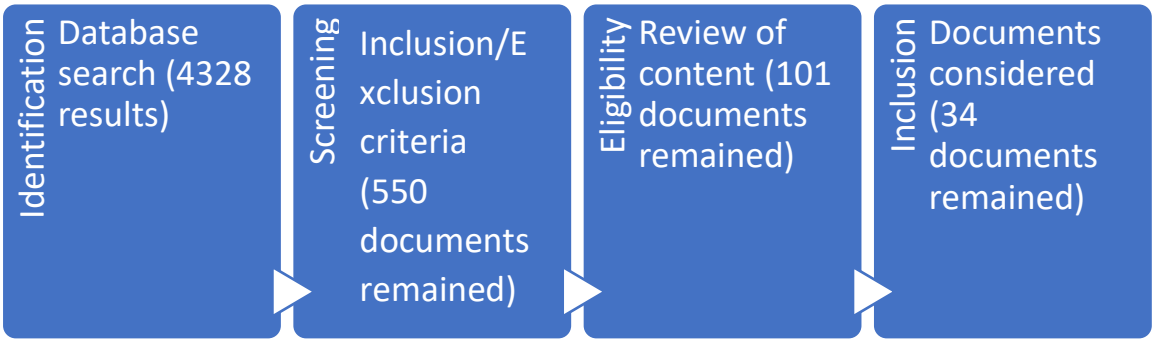
Inclusion criteria	**Exclusion criteria**
English peer reviewed studies	Secondary studies
Primary studies	Duplicate studies
Documents reporting tools	Non-English written papers
Document reporting indicators	
English published reports	
Reports published between 2000-2020	
Food retailers sustainability reports	
Companies report	
Non-governmental organizations reports	
Social responsibility reports	

Grey literature was included for two main reasons: firstly, some of the stages of the food supply chain like wholesale and retail entail the massive presence of private companies or association, whose reports can provide insights on how social sustainability is framed and measured; secondly, it has been demonstrated how including grey literature within a systematic literature review can broaden the scope to more relevant studies,

thereby providing a more complete view of available evidence (Hartling et al. 2017; Paez 2017). Adding grey literature to a systematic review is always challenging but it also makes the work more open to non-academic contributions that could bring additional insights. This paper undertakes this challenge since in this case it is particularly important to adopt a participatory approach to detect knowledge from professional stakeholders ensuring to also include their perspective.

The flow of figure 1 represents the process that has led to the final choice of documents to consider of peer-reviewed document.

Figure 1 PRISMA flow diagram for identification, screening, eligibility and inclusion of articles.



3.2 Descriptive analysis

Papers and grey literature documents gathered were divided on a spreadsheet matrix to understand key features and characteristics (Annexes 1, table 13). A table was created reporting: authors, title, year of publication, tool used, stakeholder addressed-famer, stakeholder addressed workers, stakeholder addressed consumer, stakeholder addressed-society.

3.3 Data analysis and risk of bias

From the identified tools, indicators were collected (Annex 1, table 13) and listed on an Excel spreadsheet based on stage of the supply chain addressed and stakeholder targeted. Table 14 (annex 1) containing the total numbers of indicators was then created to understand which stakeholders were the most addressed within the different stages considered. Lastly, a detailed pivot table was then created from where it was possible to understand trends and create an analytic framework (annex 1, table 15).

The risks of bias were minimized as all the documents reviewed were collected without any preference for the source, and all the indicators obtained from the tools identified were randomized and analyzed equally. No aspect of social sustainability was considered more important than another one. Although selective reporting might lead to bias, it was necessary in this systematic literature review to select only documents in which social

sustainability tools and indicators were reported. Tools and indicators collected were then analyzed using Web of Science Core Collection Marked List. The analysis aimed at showing the geographical origin of the paper, funding agencies, and grants were looked up to have a general understanding of the literature review results.

4 Results

Results are displayed following the stages of the food supply chain considered, focusing on each stakeholders targeted by social indicators. The 101 documents identified allowed the identification of 34 tools, whose indicators can measure the supply chain stages social sustainability and 30% of them were reported on papers or grey literature documents from 2017 to 2020, confirming the increased interest toward social sustainability of recent years. Most of the documents originate from European authors, specifically from Italy, England, and France. Public universities have contributed to develop the Italian social sustainability tools, whilst private companies are at the core of the French tools, as it can be seen in Pulmann (2010) and Marchand (2013). Grey literature on social sustainability originates from United States wholesalers and retailers, international organizations, and international research institutes. The funding behind the research is heterogeneous, showing that there is not a main group of universities, research institutions or private companies that hold a monopoly in funding such aspects. Production stage shows the highest number of tools dedicated to measure social sustainability followed by processing, where tools are mainly focused on the wellbeing of workers. Proceeding along the food supply chain, for wholesalers and retailers' tools are mainly represented by the Corporate Social Responsibility. Lastly, for the consumer stage, no tools, but rather good practices were identified addressing consumers themselves and society as a group of stakeholders. Indicators were divided based on the four stakeholder categories addressed. Wholesale is the stage that showed less indicator available, contrary to the retailing one, the most balanced amongst the food supply chain when targeting different stakeholders. Lastly, consumers indicator mostly targets consumers themselves, with scarce connection to other stakeholders or stages.

4.1 Production stage

Table 3 Tool for the production stage, main purpose, stakeholder addressed, author and year.

Tool	Main purpose	Stakeholders addressed	Author and year
4AGRO	Tool for sustainability assessment of farms	Farmers, Workers, Society, Consumers	Gaviglio, Bertocchi, and Demartini 2017
AVIBIO	AVIcuture BIOlogique -a method to assess the sustainability of the organic poultry industry."	Society, Consumers	Pottiez, Lescoat, and Bouvarel 2012
COSA	Committee On Sustainability Assessment-sustainability guidelines	Farmers	Committee on sustainability assessment of Philadelphia 2012.
DSR	The Driving force State Response-sustainability guidelines.	Farmers	OECD 2001
FARMSMART	Farm-Level Indicators	Farmers	Tzilivakis and Lewis 2004
FAIRTRADE	Sustainability guidelines	Farmers	Fair Trade 2019
GIF	Gender Integration Framework for women empowering in agriculture.	Farmers	USAID 2019
IDEA	Indicator of Duration of Exploitation	Farmers	Zahm et al. 2008
ISAP	Indicator of Sustainable Agricultural Practice	Farmers	Rigby et al. 2001
MESMIS	Framework for Assessing the Sustainability of Natural Resource Management	Farmers, Society	Lopez-Ridaura et al. 2002
MOTIFS	Monitoring Tool for Integrated Farm Sustainability	Farmers	Meul et al. 2008
PG	Public Goods Tool	Farmers, Workers, Society	Gerrard et al. 2012
RISE	Response-Inducing Sustainability Evaluation 2.0 tool	Farmers, Society	Häni et al. 2003
SAFA	Sustainability Assessment of Food and Agriculture systems	Farmers, Workers, Society	FAO 2014
SAFE	Sustainability Assessment of Agricultural Systems	Farmers, Society, Consumers	Cauwenbergh et al. 2007
SLCA	Social Life Cycle Assessment	Farmers, Workers, Society	Sawaengsak et al. 2019
SOSTARE	Analysis of Farm Technical Efficiency and Impacts on Environmental and Economic Sustainability	Farmers	Paracchini et al. 2015

Production stage involves food's production operations, sowing, harvesting in case of plants, animals breeding or fishery (table 3).

Health, employment, labor, and freedom of association were the most commonly thematic areas observable, found in half of the tools listed on table 3, indicating how much these thematic have a strong impact on farms

and farmers. Health was addressed by indicators such as *n° of injuries, n° of fatality rates, occupational illness*, pointing out the procurement to promote farmers in carrying out their job in a safe environment. *% of total employment, % of male employment in agriculture, % of women employment in agriculture* were the indicators defined for employment and labor, reflecting the agricultural reality of the rural community for whom a constant employment is fundamental to operate. *% of women working in agriculture* is the fourth indicator in frequency, meaning that this indicator is quite considered in terms on gender equality, followed then by *n° of women employed in a company*.

Aspects such as age and discrimination, were scarcely addressed by the tools, maybe due to a lack of indicators for the production stage. Since the average age of farmers is increasing, generational change between old farmers and young ones is becoming rare and lastly but nonetheless less important, reducing discrimination is fundamental to avert behaviors that can jeopardize people life on many different aspects (B. White 2020).

Society is the second most targeted stakeholder, deeply connected with farmers and the productive system since urban, peri urban and rural areas, constitute the environment inhabited by human beings. The indicators that express the relationship between the production system and society are several.

Another aspect that emerges from the tools regards rural communities' autonomy, specifically in the terms of social capital indicators such as *budget expenditure, level of rural funding, n° of public administration local action groups members, n° of sectoral association local action, n° of women's association local action groups member*. Through these indicators, it can be perceived that boosting social capital for these areas concern their financial autonomy, the presence of public and private sector networks, and community organizations or associations (Sánchez-Zamora, et al. 2014).

Self-employment and rural communities independence are directly linked on a farm level with wellbeing, perceived as a an increase of psychological health that can ameliorate working performance, as Markussen (2018) demonstrated. Health, employment, labor do benefit from public incentive programs that make productive use of human capital (McGrath and Murray 2016), indicators that are typical for this sector, confirmed also by Prasara (2021). Rural community autonomy is being targeted by investments in operations of regenerative farming, that aims at restoring the resilience of these communities (Price 2020). This is confirmed by (Govindan et al. 2021) who claims that for mid-size and larger dairy operations, the labor management aspects of social sustainability will be a key issue can be measured through wages and benefits, health and safety, stable employment, and retention. Education, as pointed out by (Averbuch et al. 2021), if not addressed as social value within rural communities, can jeopardize social sustainability in increasing class disparities in capitalist oriented agricultural systems. Higher education is in fact getting an increasing important role in interfacing with agriculture and agriculture-based education beyond traditional agriculture degrees (LaCharite 2016).

Shreck et al. (2006) define a connection between organic agriculture and a lacking of regulations regarding farmers and workers condition, demonstrating how, despite the good intentions of such type of alternative agriculture, a legislative backup is needed to protect workers. The role of legislation and rules in regional

sustainability, which links back to rural communities' autonomy is depicted also from Grasso et al. (2015) as fundamental in reaching social sustainability.

4.2 Processing stage

Table 4 Tools for the production stage, main purpose, stakeholder addressed, author and year

Tool	Main purpose	Stakeholder addressed	Author and year
VIVA	Evaluation of the Impact of Viticulture on the Environment standards	Workers, Society, Consumers	Martucci et al. 2019
DSI	Dairyman Sustainability Index	Workers	Van Den Pol-Van Dasselaar et al., 2012
SLCA	Social Life Cycle Assessment	Workers, Society	Sawaengsak et al. 2019
PRESERF	Processing Raw materials into Excellent and Sustainable End products while Remaining Fresh checklist	Workers	Woodhouse et al. 2018
GRI	Sustainability Reporting in the Food Processing Sector	Farmers, Workers, Society, Consumers	GRI, 2008.

In the processing stage (table 4), raw materials undergo different procedures resulting in the final food product. The most common tool used by researchers is SLCA. Five out of 34 tools analyzed measured social sustainability aspects related to this sector and workers were the most targeted stakeholders.

Fair, equal and healthy working conditions were the intervention areas mostly targeted by tools, as the related indicators consisted of *living wage per month, minimum wage per month, sector average wage per month, n° of workers associations, n° of trade unions, presence of psychological support structures.* These indicators related to working conditions, underline the need for a working environment designed to protect workers from a physical and psychological perspective. Despite the presence of these indicators, no tools reports some to measure the impact that working life has on workers' life: distance from home and forced labor aspects are in fact not addressed by any. The Sustainability Assessment of Food and Agriculture systems (SAFA) Guidelines define forced labor as those behaviors carried on by the employer that do not allow the employee to work in a psychologically healthy environment, such as keeping the workers' passports or making them live in unhealthy conditions. The conditions African tomato-pickers working in South Italy countryside were forced to withstand are a concrete example of such practices of modern slavery (The Guardian, 2019). Working in an environment which sustains workers not only within the boundaries of the company but also beyond it, is fundamental for creating ideal conditions that can boost productivity and loyalty towards the company. Yakovleva et al. (2012) confirm the importance of fair treatment and safe conditions for workers in the food supply chain, which, when met, can boost the industry's productive employment and equality achievement. Social costs brought by not respecting such safety indicators can weigh billions on a country economy, like the national social impacts of Cost Of Injuries, ranking 5th in the U.S. economy (Richter et al. 2019).

The second stakeholder category most targeted by tools is society. The most common indicators measure aspects like local employment, community engagement, contribution to economic development through indicators such as *company turnover per capita, company turnover per employee, average number of local employees hired*. These indicators suggest how much companies, in this case food processing companies, influence the surrounding social, natural, and economic environment in which they operate. Promoting local employment in rural areas can guarantee stable income for workers while increasing financial stability of the community. When companies invest in long-term infrastructure, building facilities and guaranteeing a long-term presence in the area, involving or signing contracts with local construction companies can have a high social impact on the economic development of that area. The project AFGROLAND from CIRAD in Eastern Africa has seen measured the increased food and job security as secondary effect of land investment by foreign investors in South Africa, from 2014 to 2017 (CIRAD, 2020).

Some indicators, such as *perceived use and usefulness of product* and *perceived compatibility* with product show how consumers are targeted by food industry, that adds social value to their product through labeling their food with product safety claims or guarantees (Maloni and Brown 2006) **.** These types of interrelations show how the food supply chain is a complex and dynamic supply and demand network, where stages that seems consequent in the optic of merchandise, are interlinked when the attention is shifted on social impacts on people.

4.3 Wholesale stage

Table 5 Tools for the wholesale stage, main purpose, stakeholder addressed, author and year

Tool	**Main purpose**	**Stakeholder addressed**	**Author and year**
HABERKORN	HABERKORN company tool for sustainability assessment	Workers	Kalleitner-Huber, Schweighofer, and Sieber 2012
UFP	Urban Food Planning	Society, Consumers	Morganti 2011
CSR, G4 Guidelines	Corporate Social Responsibility guidelines	Workers, Society, Consumers	Jones, Comfort, and Hillier 2007
SCPM	Supply chain performance measurement	Workers, Consumers	Callado and Jack 2017

Wholesale receives processed food from industries and sells it to retailers. This stage has the fewest number of social sustainability indicators (table 5), as 4 out of 34 tools were found addressing workers, society and consumers, no mention of farmers.

Aspects concerning employee's quality of work appear for the first time and are addressed through indicators mainly based on Likert scales such as *employer image, employee expectations, perceived HR service quality, value perceived by employee, employee satisfaction.* This might indicate the importance for these companies to rely on their workers motivation. Despite the shared interested in assessing the wellbeing of their own workers and customers, tools report any information regarding social impacts uphill of the supply chain. In

fact, within certain food supply chains, wholesalers represent a bottleneck in the chain, like in the chocolate one, where a few wholesalers buy most of the cocoa supply controlling the market. A lack of indicators that measure how the wholesale stage impacts the farmers ahead of them on the supply chain constitutes a gap within the literature. The relationship between wholesalers and society is somewhat addressed within tools that deal with aspects like capacity of supplying a city or a local area with a variety and a good quality of food products, required by consumers. These aspects may play a fundamental role in tackling aspects like food deserts, i.e. an urban or rural area in which it is difficult to buy affordable or good-quality fresh food compared with area with higher access to supermarkets or vegetable shops with fresh food (Dutko, Ver Ploeg, and Farrigan 2013).

Consumers are besieged via indicators like *product responsibility, customer satisfaction, customer loyalty and responsiveness to clients***.** These indicators suggest, similarly as workers, wholesalers are interested in gaining loyalty from customers. The relationships wholesaler-customer is not based on a pure monetary return: to gain trust companies can create healthier product for the final customer, promoting for example a healthy lifestyle. A lack of social indicators in this stage may lead to dire consequences for the corporation involved. Longoni & Cagliano (2015) confirm that socially oriented companies have better long-term performance than others. Companies that do not address social concerns can jeopardize and damage their reputations (R. D. Klassen and Vereecke 2012; Huq, Stevenson, and Zorzini 2014). Wholesalers are responsible for their choice of suppliers, tying them to the social performance of those suppliers. A poor choice or neglect of the social performances of their suppliers can tarnish the corporations brand image, leading to poor economic performances (Mani, Jabbour, and Mani 2020).

4.4 Retail stage

Table 6 Tools for the retail stage, main purpose, stakeholder addressed, author and year

Tool	Main purpose	Stakeholder addressed	Author and year
CSR	Corporate Social Responsibility	Farmers, Workers, Society, Consumers	Companies report (2019-2020)
SCPM	Supply chain performance measurement	Workers, Consumers	Callado and Jack 2017

Retail stage (table 6) typically sells goods directly to consumers through shops, and 2 out of 34 tools were found from literature to contribute to assess social sustainability. Being the first stage with direct connection to consumers, it is most responsive to their buying preferences, and it is fundamental for retailers to gain customer trust and appear nowadays as sustainable as possible to retain customers.

Indicators that measure that address farmers regards aspects like supplier's standards presence**,** through *% of purchased volume from suppliers compliant with company's sourcing policy* and *% of purchased volume which is verified as being in accordance with credible, internationally recognized responsible production standards*,

broken down by standard. Standards increase social sustainability in two different ways: they guarantee consumers that the product chosen has been produced following regulations that protect workers or the environment, and the farmers who adhere to these regulations benefit from buyers' preferences.

Concerning retail's employees, the indicators are related to inclusive and diverse working environment**.** Inclusive working environments can have positive social impact in small and rural areas, where retailers often represent stable job opportunities in areas where jobs are scarce. Moreover, having an inclusive and diverse working environment is helpful to gain customers trust, aligning retailers' values to those of the customers served. Organic shops have as clients, people who are aware of the sustainability of their choices. Since retailers are the only stage of the supply chain, which is directly exposed to the final consumer, if the latter perceive disrespect of workers, the implication could jeopardize retailers' incomes if customers decide to boycott the shop itself. This has happened in the past with companies that were removing gay families from brochures or refusing to sell wedding cakes to same-sex couples (Bloomberg, 2019). This might be confirmed by the indicator *% of responsible supply chains***,** that targets social sustainability from a society perspective revealing how much important is for retailer to rely on sustainable supply chain overall, and not for a single stage. This indicator is probably one of the most important, but it can only be found at the retailer stage, entailing a sense of knowledge sharing and communication across the supply chain benefiting all stakeholders.

Percent of local employees results as one of the most used indicators by social sustainability tools, confirming as well as for wholesalers, the potentially strong impact these vendors have when they decide to pursue development strategies that takes into account the needs of the areas, they settle in.

Lastly, retailers can have a strong social impact on the stakeholder they depend on for their, customers. *Presence of diverse and inclusive products and marketing* are probably the most important indicators as it is necessary for retailers to create an environment in which customers can identify. Moreover, the ongoing COVID-19 pandemic has highlighted the vital role retailers have in suppling consumers with a constant flow of goods and a vital source of social interactions for citizens under lockdown. A functioning, diverse, and responsive retailing system has been shown to be fundamental in emergency situations (Ihle et al. 2020).

The attention retailers place on CSR and the relationship with other stakeholders of the food supply chain has significant impact on the reputation of firms and can nudge consumers to buy certain brands, improving companies' financial performances. Luo and Bhattacharya (2006) confirmed the positive implications related to retailers' and stakeholders' social inclusion, where firms with low inclusion capability were harming their profits. Examining Swedish supermarkets, Chkanikova and Mont (2015), concluded that indicators such as % *responsible supply chain*, that mirror the company attitude towards such matters, are of great importance for retailers for achieving upstream and downstream social sustainability along the food supply chain for the diversity of stakeholders involved. Delai and Takahashi (2013) report internal social practices within Brazilian retailers showing how much workers and society are the most targeted stakeholders, through employees' sustainability training that aim at expanding diversity and human rights actions beyond standards legally

mandated, developing codes of conduct encompassing anti-corruption, bribery and competition practices, and disclosure political contributions.

4.5 Consumer stage

Table 7 Tools for the consumer stage, main purpose, stakeholder addressed, author and year

Tool	Main purpose	Stakeholder addressed	Author and year
SEM	Structural equation model + CSR	Customer	Nguyen et al. 2020
CSR	Corporate Social Responsibility	Customer	Hartmann 2011

Consumers represent the final stage of the FSC (table 7). What consumers buy strongly influences the decision making of all uphill actors in the food supply chain. Despite this, only 2 out of 24 tools have been identified in terms of social sustainability. Consumers are the lynchpin in creating demand. For this reason, social sustainability related to consumers is mostly related to how producers, industry, and retailers relate with the former and the type of experience food can have for consumers themselves. Consumer social responsibility can be defined as socially conscious or morally motivated consumers who buy ethical products that match their ethical concerns (Caruana and Chatzidakis 2014). A Vietnamese study regarding food processing, showed consumers' perceptions of CSR toward the community has the most substantial influence on consumers' attitude, followed by the perceptions of CSR toward employees and the perception of fair operating practices responsibility (Nguyen et al. 2020) . From the study of Hartmann on CSR, indicators such as *reputation of the company*, *credibility of the company*, *consumer-company identification*, *consumer loyalty* were found to be addressing the relationship that companies have with customers. These indicators signal for the importance of a company's brand attractiveness.

Consumers could react confidentially to socially sustainable actions pursued by corporations and the consequent benefits achieved could improve the overall level of sustainability of the whole supply chain (Hsu, et al. 2016). Moreover, several stakeholders can play a role in the *education of customers* as a means of raising awareness on sustainable consumption, incentives to buy eco-friendly products, advice regarding a products' sustainability aspects, usage, and disposal (Delai and Takahashi 2013; Lixu Li et al. 2021).

5 Discussion

Measuring social sustainability is receiving increased attention in academic research and civil society. We found 34 measurement tools in total with some targeting a single stage of the supply chain and others targeting several stages. Departing from previous studies, our analysis of lenses provides scholars and practitioners a comprehensive look at the tools and indicators available for supply chains in whole or part via an understanding of which stakeholders are targeted at each stage. Below we focus on implications of our findings, first for the two supply chain stages where the development of social sustainability indicators is needed most and then we present the social sustainability indicators found in terms of fit with the SDGs broadly.

5.1 Hotspots for intervention

The wholesale stage of the supply chain lacks an adequate set of indicators for measuring social sustainability among diverse stakeholders, since farmers and society are not targeted. Wholesale represents a bottleneck of the supply chain in terms of social sustainability. Due to competitive trade practices, wholesale traders have substantial impact in rural production areas and larger markets. As such, particular attention via social sustainability indicators is needed to mitigate effects of profit-motivated decisions that could harm communities (Sharpe and Barling 2019).

Alternatively, retail stage has the most complete set of indicators in terms of relations with other stakeholders throughout the supply chain. Both wholesale and retail bargaining power and strategic placement are at the intersections among different supply chain actors (Ansah, Gardebroek, and Ihle 2019; Ihle et al. 2020). Wholesalers and retailers are able to enforce specific sustainability objectives both in production and consumption practices (Villena 2019). Adhering to social and environmental standards can in fact create a cascade effect of sustainable practices that flow through the supply chain. Since retailers interact with all stakeholders, organizations could design best practices or collective standards capable of serving as examples for companies in general. For example, a few retailers can have significant influence on prices within large markets (Panagiotou and Stavrakoudis 2018; Sanderson et al. 2016) and consumer behaviors such as encouraging healthy choices (Houghtaling et al. 2019) or fostering sustainable consumption practices (Shaw and Shaw 2019) which impact the communities where they operate.

For indicators across the supply chain, a common target is creating better working conditions for stakeholders. Despite this, several gaps exist. In a few stages of the supply chain, improved working conditions are limited and omitted in others, jeopardizing the social sustainability of the entire chain.

Although the thematic area of food security was found along the supply chain, further examination is needed to understand which indicators best measure it. The FAO, for example, lists nearly 30 indicators that can measure food security, through aspects like food availability, access, supply stability, and utilization (FAO 2020). Food prevention indicators were mostly found in the retail and consumer stages and were mostly related to packaging functions as solution for food waste and consumer education. Material and packaging in the retail stage may have social repercussions on price, influencing consumer choice, as demonstrated by a recent study showing consumers benefit from zero packaging products, saving money, but are willing to pay a premium for sustainable packaging (Beitzen-Heineke et al. 2017).

The indicator *education to food waste*, relevant to the retail stage, stresses the role of private companies in educating the consumer to overcome lack of government awareness of policies. Because of their dominant buying power, retailers can influence food loss and waste (FLW) further upstream (i.e., primary production, processing, and manufacturing) and even distribution. They are typically placed before final consumption in the food supply chain, creating high variability within the retail sector which can lead to FLW in the food service and household stages (Aschemann et al. 2016). FLW in retail can be caused by any number of factors,

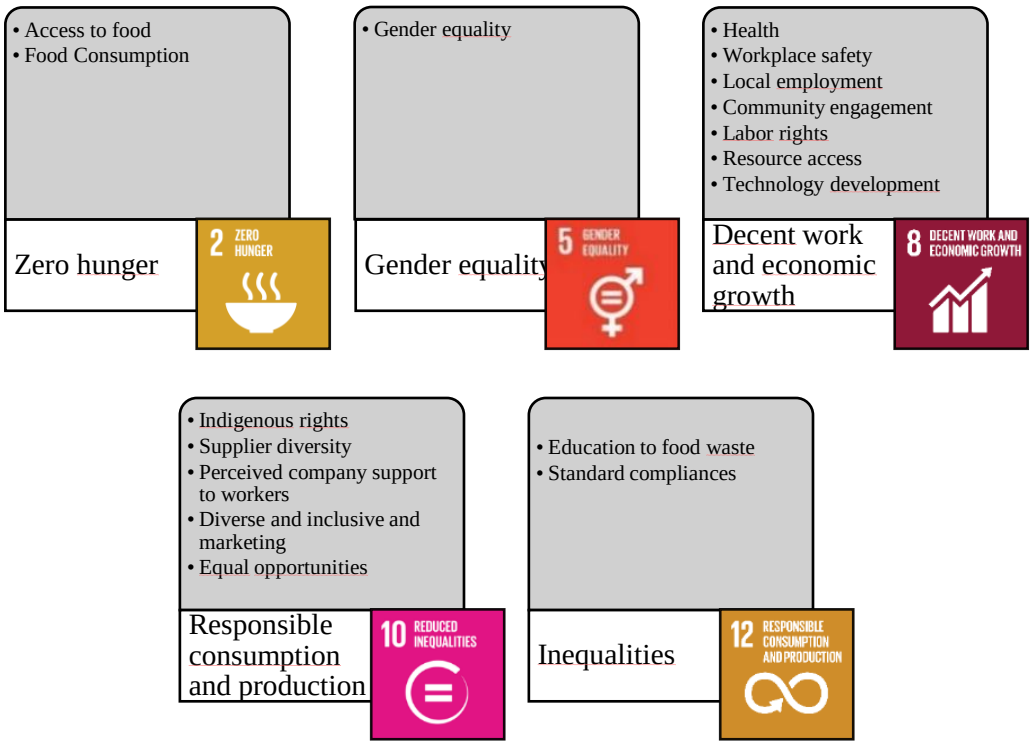
including but not limited to: damage and spoilage, lack of cold-chain infrastructure, delays during transport (e.g., border inspections), variable customer demands, modification or cancellation of orders, inaccurate customer forecasting and overstocking, reliance on inefficient stocking practices or product sizes, misinterpretation of food safety standards, and misleading or confusing date labelling (de Moraes et al. 2020). Among others, methods to measure food waste at a retail stage include direct measurement, waste composition analysis, records, diaries, and interviews (Tromp et al. 2016; Whitacre 2019).

The low frequency of indicators such as *young generations* may point out how young people are left out from the discussion around sustainability, specifically the social one in the food systems, contrary to what an inclusive approach should do. The opinion of young people on such topics is particularly important because they represent the future of society and must be enabled to express their perceptions and perspectives.

5.2 Indicators Fit with the Sustainable Development Goals (SDGs)

The indicators within the identified tools contribute to the achievement of some of the SDGs specifically SDG 2 Zero Hunger, 5 Gender Equality, 8 Decent work and economic growth, 10 Responsible consumption and production, and 12 Inequalities (Figure 2). Most of the indicators belong to SDG 8 and 10 since the review addresses social sustainability aspect related to workers. SDG8 shows the highest number of indicators that contribute to its achievement. A healthy, safe, and stable working environment is fundamental to society and tackling global unemployment effects, particularly in the agricultural and food supply chain, which see large shares of workers. Gender equality contributes to goal 5 in addressing the phenomena of gender gaps in the agricultural sector where women have particularly important roles worldwide especially in developing countries (ILO 2015).

Figure 2 Most frequent indicators divided by Sustainable Development Goal addressed



It is evident the role wholesalers and retailers have in influencing the sustainability of food supply chains and the well-being of diverse stakeholders, not only in terms of environmental and economic attributes, but also social. Future research is needed to establish a framework for measuring sustainability as a constant and unceasing thread, in a clear and objective perspective, free from external influences of private companies, to fill current knowledge-practice gaps.

5.3 Research implications

The increasing inclusion of social sustainability indicators within tools can be explained with the waves of food activism, the revision of governmental policies, and the financial innovation aimed at responding to the emerging societal challenges. This transition is driven by a renovated need of assessing how much a single measure can ensure benefits and by the opportunities new technologies might offer for data collection and management (Howaldt 2019). Within production and consumption domain, this translates into association and companies seeking to understand to minimize bottlenecks and supply chain disruptions in terms of sustainability . Through the tools and indicators analysed in this work, it was possible to define different strategies, that have emerged as drivers of change for social sustainability: boosting tracking technologies (indicator: *% of supply chain tracked)* such a blockchains; assessing the social impacts of small and medium enterprises (*n° of job created)*; viewing marketing as a driver of change especially in term of the economic clout of millennials and generation X (*% of ethical products bought)*.. Regarding the indicators found throughout the literature, some areas show a low level of permeation in terms of innovation and readiness to social changes (Armenta et al. 2017). This emerges as a remarkable case within the production stage, where often due to low generational turnover or lack of means and infrastructure, the adoption of new measures is slow (Yigezu et al. 2018). Predominantly, indicators were found to be more focused on safety aspects, though differently to other stages, yet other aspects, such as personal wellbeing, education, and fair salaries are rarely considered (Sarkar et al. 2020). In fact, recognizing social justice emerges as priority in worldwide agendas, especially within periods of great change where the COVID-19 pandemic has reshaped the concept of wellbeing in the workplace (Patrício Bispo Júnior et al. 2020; Walter 2020).

In general, social aspects have been often addressed as an unclear area where further research was needed (Fecher et al. 2021), and in academic literature, most consider social aspects together with environmental and often economic ones; rarely is social sustainability considered as a self-standing subject, that needs to be integrated but with autonomous and define boundaries. This paper aims to reduce the gap evidenced by comprehensively revising social sustainability starting from the available tools and indicators that reveal where most of the efforts are put into place along the food supply chain by the different key actors engaged.

6 Conclusions

This study sought to offer a systematic review of the current state of social sustainability in food supply chains in the scientific and grey literature. By adopting the perspective of stakeholders, we offer a new lens for assessing the current state of social sustainability metrics and indicators. Attending to the social and cultural dimensions is fundamental for human achievement of an overall sustainability in production processes, regardless the sectors considered. Agriculture and the related processes that happen along the food supply chain are the basis of human sustainment. The awareness that this sector has on the world has boosted the introduction of good practices from an environmental and economic point of view, but on a social perspective, there is a potential gap for improvement and implementation.

Industry and governance tools for measuring social sustainability indicators have increased in recent years. Academic literature has lagged. In academic literature, much attention has been given to the first stages of the supply chain, while the wholesaler, retailer, and consumer social aspects are more of a private subject. The complexity of supply-chain studies has yielded a gap in literature concerning studies of social sustainability along entire food supply chains.

The production stage shows the most abundant tools and indicators, especially quantitative ones, underlining the deep connection farmers have with the environment they operate in and other stakeholders: despite being the productive stage at the beginning of the supply chain, most of the decisions are influenced by what happens downhill. In fact, the consumer stage shows the lowest number interactions, despite the role consumer demand has on the entire supply chain. Social aspects in the most commercial stages of the supply chain are addressed privately and data lack. Few of the indicators address social aspects like gender equality, women empowerment, and youth involvement, revealing a gap that needs to be addressed to achieve a more inclusive approach to sustainability of food systems in general, especially in terms of social justice, fundamental to achieve many SDGs.

The lack of tools and indicators for the wholesale stage results in a disequilibrium in social sustainability approach, that can be addressed by policy makers and researchers. Actors of the food supply chain benefit from the implementation of social sustainability aspects, although these become inconsistent if not respected in the next stage of the supply chain. Measuring social sustainability should represent a crucial requirement in assessing supply chain performances, integrating environmental sustainability, but considering it as an interrelated but self-standing dimension. Addressing the bottleneck in the wholesale stage may represent a game changer for all stakeholders, from the productive and processing stages to the final consumer stage. Finally, further studies are required for extending the discussion on social categories not taken into consideration, and to offer guidance in novel strategies to assess future social sustainability within the food supply chain.

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CHAPTER 2: Defining and testing new food systems social sustainability indicators through youth engagement for informed and robust policy insights

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Abstract

Moving towards sustainable food systems is a shared objective of worldwide development agendas made difficult by rapid growth of population, climate change, water demand, biodiversity loss, and the COVID-19 pandemic. In this uncertain environment, many variables must be taken into consideration for making decisions. Understanding how trends could change and evolve in the future is essential for scientists and decision-makers across sectors and scales to make informed decisions on policies. To make these policies more effective, it is crucial to engage citizens, especially young generations, who will experience those policies firsthand. The aim of this research is to define and test new food systems social sustainability indicators through youth engagement for informed and robust policy insights, to provide policymakers suggestions that would incorporate citizen's needs, specifically young generations ones. This research draws on the Community Dissonance Theory, whose principles underline the existing gap between policy makers and communities. A literature review is conducted to define the most probable future food systems scenarios. These are evaluated by youth through focus groups, whose results are analyzed in NVivo and then translated into a survey to confirm the results with a wider platform. Four scenarios resulted from the literature review, namely 1) Elitarian Society, 2) Inclusive and environmentally friendly society, 3) Consumerist closed up society, and 4) Society 2021.Twenty-eight sustainability thematic areas emerged from the focus group discussions, which led to the identification of 31 new food system indicators, 20 of them on social aspects. Indicators were then inserted within survey questions to be evaluated by a convenience sample of 524 respondents, belonging for 50% to Generation Z (1997-2012). In terms of SDGs, acting for the climate, achieving zero hunger, and improving education are top priorities for the majority of respondents. Respondents want greater access to farmers markets, more food education courses, and increased certifications that guarantee the sustainability of products. Most reported dissatisfaction with food waste management of their municipalities.

1 Introduction:

Considering the challenges that society will have to face soon, the identification of adequate policies to promote sustainable behaviors and choices is fundamental. This is of relevance for food systems, which have been demonstrated to be influenced by the behavior of consumers and citizens, who shape through their choices purchase trends and patterns. To encourage adherence to virtuous models of sustainable way of leading life, it is necessary to leverage young people, whose feedback on sustainability issues can help make policies more effective.

Dating back to Paris Agreements to the more recent European Green Deal, countries are more and more involved in taking actions and adopting measure to achieve a sustainable development and reshaping food systems into more sustainable, equal, and fair ones is the main objective of most of the Government agendas in the world (UN 2015). Besides focusing on sustainable production and consumption, food systems ought to be now regenerative (Pascucci 2020), meaning that instead of consuming and degrading the environment, they should contribute to stabilize the planet's climate, through the introduction of practices that reduce the carbon foot print and increase fertility. Social sustainability represents in this case a mirror of the need to put society at the center of the question, not in a human-centric perspective, but rather as in balance between the concept of planetary boundaries and social boundaries (Raworth 2017).

Society might face food shortages in the future, or, according to the most recent pandemic and climate events, is unprepared to face several scenarios on a short term. Current and future challenges include the impact of more frequent and extreme weather events related to climate change (CC) and the consequences of the COVID-19 pandemic that are reshaping trade systems and redesigning international commercial and political relationships (Fanzo et al. 2018; Weersink et al. 2021). The COVID pandemic has shown that current food systems are fragile, and their discrepancy can jeopardize billions of people (Glover and Sumberg 2020). The pandemic impacted food value chains causing a general rise in prices, increasing food insecurity, and increasing news coverage on these issues (FAO 2021). Policy makers need insights into the future development of food systems to make better choices (Anderson and Leach 2019).

Predicting how food systems will develop in the future is fundamental to shifting them from unsustainable to resilient and regenerative ones (S. Klassen and Murphy 2020). The use of strategic foresight in food systems, may contribute to anticipating issues that policy makers and industries can design policies that meet societies' needs and sustainability goals. In fact, policies and implementation strategies that match the needs and principles of a population are more likely to be followed (Leeman et al. 2017).

Seemingly, in the agricultural and food systems field, food supply chain disruptions have acted as catalysts for social unrest (Barrett 2020), which at the same time could represent a chance to transform food systems (UN 2021). Therefore, to achieve sustainable food systems it is fundamental to rely on the measures that meet people's needs to increase acceptance. Since food systems are based on interconnected people, an insight from those living it can be useful to tailor suit policies, specifically, young generations, that represent the current

and future users. Identify possible scenarios, that are plausible to happen at least on a local scale can be a smart solution to improve systems responsiveness. Exploring what impacts they could have can lead to the identification of potential implications for policies (OECD 2019). What is needed is a shift from a mentality of here-and-now, towards more resilient process that promptly react against abrupt changes with readiness and efficiency. Anticipatory capacity and the ability of being future fit are all skills that governments, and policy makers within them, need to consider, in a world were identifying new scenarios can be the only way to prepare a set of policies that can face mitigate negative effects (Bratanova et al. 2018).

Consumers should not forget that their choices shape food supply chains. Solutions to complex challenges in the food system need the active participation of citizens to drive positive change. To achieve this, it is crucial to give citizens the agency in processes of designing policy interventions. This requires authentic and reflective engagement with citizens who are affected by collective decisions (Doherty et al. 2020). In today's calls for a shift towards more sustainable behaviors, it is key to comprehend how citizens are influenced and nudged towards sustainable choices, and their opinion on this matter (Lehner, Mont, and Heiskanen 2016)

Engaging young generations on sustainability matters is of fundamental importance to foster the current and future achievement of global sustainable development agendas (UN 2019). There is significant interest among policy makers and development associations in channeling the energy and engagement of citizens, specifically young voters to change food system (FAO 2014), considering not only the needs of the generation-in-chief, but also taking into account thoughts, perceptions, opinions, doubts and fears of those who will soon be in charge (Piselli et al. 2019). Future generations will address the consequences of today's actions.

Understanding youth perspectives on sustainable food systems are aspects tackled by behavioral economists, who seek to forecast trends and future choices (Challenger and Clegg 2011; Gayathri, Aparna, and Verma 2017). Crowd forecasting represents an innovative technique to obtain information on trends, opinions, and indicators on several aspects through future forecasting methodologies like drivers of challenge analysis, scenarios, and wind tunneling (Glover, Hernandez, and Rhydderch 2016). Despite being civil society at the center of sustainable development agenda, like the social pillar in the New European Green Deal (European Commission, 2019) and worldwide living labs initiatives (Cardullo, Kitchin, and Feliciantonio 2017; Chronéer, Ståhlbröst, and Habibipour, 2018 .; Puerari et al. 2018), further research is needed on regarding how civil society perceives sustainability, which indicators civil society believe are useful, specifically for what concern youth in taking part into this dialogue, on food systems and on food supply chains (Desiderio et al. 2021).

As Generations Y, commonly known as millennials, (born between 1981 and 1996) and Generation Z (born between 1996 and 2011) become more influential consumer groups and workforce demographic, the demand for sustainability is likely to increase (Dabija et al. 2017; Bogacki and Letmathe 2020). This may lead to change in their current lived experience, embracing more radical and disruptive habits necessary to deliver sustainability (Eames and Egmose 2011). Sustainability aspects are usually analyzed through the perspective of experts thanks to DELPHI techniques analysis (Ahmad and Wong 2019; Flinzberger, Zinngrebe, and

Plieninger 2020), although citizens' opinions on such matters are rarely taken into consideration, let alone young generations ones (Jaafar, Noor, and Rasoolimanesh 2015; Suchanek and Szmelter-Jarosz 2019).

The previous research work has highlighted a gap of what civil society, specifically young generations, in the process of connecting social sustainability indicators in the food supply chain. Future generation should play a role in defining what social indicators must be present in food supply chains, which could allow government and policy makers to tailor policy outcomes in accordance with what civil societies consider important. Graduate students belong to the so called Generation Z, which consist of persons born between 1997-2012 (Chicca and Shellenbarger 2018; Jurenka et al. 2018). Generation Z shows common traits with previous generations, Millennials, though uncertainty and indecisiveness towards sustainability issues seems increasing (Fry, 2018 ; Parker, 2019). Inquiring graduate students' opinions on sustainability matters can help identifying trends, specifically for aspects of sustainability that have historically left aside, such as the social dimension (Higg and McMillan 2006). Due to the great impact young generations can have on agricultural and food systems with their choices, it is of major interests to understand their opinion on the social sustainability aspects of the food supply chain, specifically when it comes to stakeholders involved, like farmers, workers, society, and consumers themselves.

This research builds on the framework of an online research project called "…e Poi?", launched in 2020, which aims at engaging young generations in imagining the future through an exercise of crowd foresight and further develops it. The final aim of this research is to define and test new food systems' social sustainability indicators through youth engagement for informed and robust policy insights, to provide policymakers suggestions that would incorporate citizens' needs, specifically young generations ones.

1.2 Theoretical framework.

This study draws on several theories of community dissonance, which conceptualize the communication gap between knowledge producers and consumers as multidimensional in nature, encompassing a set of professional and institutional cultures that shape how professionals think, act, and perceive the world (Caplan 1979; Friese and Bogenschneider 2009; Bogenschneider, Corbett, and Parrott 2019). Young Europeans can be catalyzers and leaders of a global shift towards a climate-friendly world. It is commonly accepted that young generations are at risk due to CC and although they have done the least to cause it, they will experience its impacts first. The success of the Fridays for Future movement, initiated by Greta Thunberg, is based on a deep sense of injustice that youth are experiencing due to the threat posed by CC on their lives (Isacson 2020).

From a conceptual perspective scenario analysis focuses on identifying the consequences of interactions among the boundary conditions, driving forces, and system components. It is primarily a scientific effort, employing a variety of statistical and other analytical techniques to examine the scenarios constructed in the prior phase (Mahmoud et al. 2009). This research takes into consideration scenarios that have already been theorized by other authors but combines them to create a more complete set. Since the food systems, and food

supply chain that constitute them, embed both environmental and socio-economic elements, for an integrated assessment of sustainability these variables have been taken into account for scenarios selection.

2 Literature review

Society is witnessing a paradoxical rise both in obesity and undernutrition combined with a gradual depletion of resources, that made humanity aware of the unbalanced structure of food systems which can only be turned addressing new sustainability challenges (Bacq and Janssen 2011; Raudsepp-Hearne et al. 2020). Sustainability must be the pivot around which food systems, and specifically food supply chains are reshaped, to become robust and reliable in the future. This is important for as a new variable has entered the equation of food systems development, the ongoing COVID-19 pandemic. Global pandemic spurs new uncertainties prompting responsive policies that mirrors societies' changing needs. Although world Governments tout the pursuit of sustainability targets, it is difficult to predict future food systems trends, and the consequent influence on supply chains (Dury et al. 2019). Due to the uncertainty of the great challenge's society faces and potential solutions available to tackle these issues, emergent field of *futures research* which uses scenario research and scenario planning, tool are often used as a tool to investigate assumptions, uncertainties, and general outcomes of the different paths human beings will follow (Molina-Besch, Wikström, and Williams 2019; Ivanov 2020)

The scenarios are descriptions of how a specific system could develop in the future, based on a coherent and consistent set of assumptions about key drivers and the way these latter intertwine (Cork et al., 2003). Moreover, scenarios are carefully constructed snapshots of the future and the possible ways a sector might develop, which can help focus thinking on the most important factors driving change in any field. By considering the complex interactions among these factors, legislator, policy makers, and research institutions can improve their understanding of how change works, and what can be done to guide it (OECD 2021). Understanding the opinions and perceptions of young generations regarding sustainability aspects of the food supply chain is crucial to shaping future policy(Meyer 2020).

2.1 Scenario definition

Scenarios derive from a combination of different variables and drivers usually categorized in three different classes: first-class baseline scenarios, second-class exploratory scenarios, and third-class normative scenarios (van Dijk et al. 2020a). First class scenarios are "business as usual" scenarios, baseline projection that describe the future as no policies would influence it. Second class scenarios are explorative ones, designed to lead the thought of the participant outside normal scheme. The third class of scenarios consists of normative ones, designed to support objectives through the achievement of specific targets. The normative-narrative scenario approach focuses on a participatory communication process involving heterogeneous stakeholders and it aims at catalyzing normative positions and at developing desirable images of the future by the mean of

goal scenarios. Literature reveals (Deloitte Sustainability 2017; Benton 2019; Raudsepp-Hearne et al. 2020; van Dijk et al. 2020; Mora et al. 2020) that most recent scenarios developed by previous authors are based on typical cartesian models, in which two lines define two opposite dimensions, whose intersection define four areas. These four areas represent futures that usually stem from reality and present rigid characteristics. Table 8 reports the main authors who have been selected for reporting similar scenarios structures.

Table 8 Food systems scenarios collected through the literature review.

Author and year	Scenarios	Key elements and drivers
(Deloitte 2017)	Unchecked consumption	The world of 2016, accelerated into 2030: high growth, with consequences; Markets boom and trade increase; Technology spurs efficiencies in food production and distribution; Yield is priority #1; Obesity and health costs skyrocket as billions transition to a Western-style diet; The footprint expands; natural resources are severely depleted.
	Open-source sustainability	The world's currency is trust; there is a rise of a "mutual benefit" philosophy; A proliferation of food sources reduces overreliance on a few bread baskets; Open platforms improve tech accessibility, but long-term R&D is disincentivized; markets and policies enable "sustainable" choices; A rural transformation attracts youth to data-driven agriculture;
	Survival of the richest	Broad distrust in globalization results in slow economic growth and volatile markets; Multiple Undeveloped Countries are in crisis with accelerating poverty and hunger; Fear and market volatility prompt nationalist sentiment and isolationist policies; Income gaps widen; Climate change continues unabated; Population growth and food prices prompt increased conflict and migration; Technology innovation is defined by broad disparity of access and adoption.
	Local is the new global	In a disconnected global market, nations turn inward; Comparative advantage is lost; Food movements thrive, with a focus on traditional diets and local production; Progressive policies have reduced the price point for healthier diets; Shorter supply chains and increased plant-based diets reduce environmental strain; Import-dependent nations suffer; hunger hotspots proliferate; Country-specific innovation flourishes but diverse standards hamper scale.
(Benton 2019)	Unchecked consumption in a globalized world	Business as usual; Increased population growth; Global homogenization of diets; Intensive livestock.
	Global, green, and healthy	Globalized cooperation; Preventive healthcare; Fewer climate impacts; Small-scale but intensive horticulture.
	Sovereign (in)sufficiency	Sovereign states and control on market; Loss of agricultural efficiency; Super intensive agriculture; Little international cooperation.
	Localized and sustainable	Circular food systems; Agricultural policy driven by nutritional needs; Mitigated climate change
(Raudsepp-Hearne et al. 2020)	Global knowledge for local management	Revived agricultural landscapes; Innovative & dynamic communities; New social infrastructure to enable cooperation; Urban greening & decentralization, Culture of biosphere stewardship, Focus on social technologies; Extensive flexible, smart, public transport;
	Wild and tele-connected	Human civilization is embedded within rewilded ecosystems; People & Communities are virtually connected; Empathy among people & with other species is highly valued; De-urbanization people live in

		dispersed ecological settlements; Autonomous nature has strong rights; Social-disorganization is a problem for crisis response.
	Creative and collaborative	Rewilding of agricultural landscapes; Increase in affinity-based communities; Diversity highly valued; Increased but dispersed urbanization; Creation of novel and designer ecosystems; Artificial food technology replaces most meat; New masculinity, diverse family structures; Frequent small conflicts addressed by conflict resolution among communities.
	The league of cooperative communities	Multifunctional cultural landscapes; People live in diverse cities and place-based communities with deep histories; Innovation and autonomy highly valued; Wealth Accumulation limited; Greening of existing urban areas; Easy peer-peer collaboration; Military abolished; Major crises over energy use and population growth.
(van Dijk et al. 2020b)	One percent of the world (ONEPW)	Income per capita growth high in HICs, medium in other; Inequality increased between and within regions; Population growth Low in LICs, high in other regions; Technical change High crop yield growth: convergence; Globally connected elites; Strong international cooperation between the elite; Sustainable use of natural resources, managed by the elite; Medium-meat diet; Low food waste and losses; Medium migration; Policy orientation toward the benefit of the elite; Low climate change impact due to mitigation and adaptation technologies.
	Ecotopia (ECO)	Income per capita growth low in HICs, high in other regions: convergence; Reduced inequality between and within regions; Low population growth; Rapid technical change; Crop yield growth stagnating in HICs high in other region: convergence; Globally connected markets; Strong international cooperation; Sustainable use of natural resources; Low meat diet; Very low food waste and losses; Medium migration; Policy orientation toward sustainable development;Climate change impact low due to mitigation
	Food for all but not forever (FFANF)	Income per capita growth very high in all regions: convergence; Strongly reduced inequality, especially between regions; Relatively low population growth; Rapid technical change; High crop yield growth but eventual collapse: convergence; Strongly globalized; Medium international cooperation; Unsustainable use of natural resources; High-meat diet; Hight food waste and losses; High migration from low income counties to high-income ones; Policy oriented towards free markets and growth; Climate change impact high due to lack of mitigation.
	Too little too late (TLTL)	Income per capita low in all regions: divergence; Inequality increased; Medium population growth; Slow technical change; Low divergence in crop yield growth; De-globalizing and national focus; Unsustainable use of natural resources; Medium-meat diet; Policy oriented towards national priorities; Climate change high.
(Mora et al. 2020)	Metropolization	Runaway climate change; Decrease in crop yields; Transitional food diet; Conventional intensification of cropping systems; Conventional intensification of livestock systems
	Regionalization	Moderate climate change; Decrease in crop yields; Regional food diet; Sustainable intensification for cropping systems; Conventional intensification for livestock systems; Agroecology for cropping and livestock systems
	Healthy	Stabilized climate change; No variation in crop yields; Healthy food diet; Sustainable intensification for cropping systems and agroecology for livestock systems Agroecology for cropping and livestock systems

	Communities	Moderate climate change; Decrease in crop yields; Regional food diet; Agroecology for cropping and livestock systems, but in a context of lower R&D investments; Collapse of cropping systems and backyard livestock

2.3 Participatory approach and young generations

Young generations represent the future leaders of sustainable development, posing questions, interrogating issues regarding sustainability and their role in how to contribute to achieve it (European Commission 2018). Turning youth into change makers while developing their critical thinking is fundamental for allowing them to play an important role in the achievement of sustainable development goals (UN 2020). Shocking consciences and raising awareness on the impact of daily habitudes on the environment, society and markets have, is what is characterizing the new wave of environmentalist movements of these recent years. Supporting young people in becoming active citizens working towards a sustainable future, supporting people of all ages in adapting skills to the needs of society and creating a Sustainable Development Goal culture shift may be the key for a bottom-up approach change for a sustainable future (IYESD 2017). The recent environmental strikes inspired by the young activities Greta Thunberg have fueled the feeling of acting against climate change that cyclically lurk within young people. Worldwide events like "Fridays for future" school strikes, have and still are witnessing the participation of millions of youngsters worldwide to demand to their Governments and adequate and prompt actions, measures and laws against the rampaging effect of climate change (The Guardian 2020). Apart from raising awareness amongst young generations, these movements, are a mirror of the willingness youngsters feel in being involved in the dialogue for what related climate change and their future (Ojala and Lakew 2017). Intergenerational dialogue can in fact lead to a beneficiary exchange on fostering positive actions on the environment. Several aspects of raising awareness can consist in showing young people how the environment in which they live can change, and the socio-economic impact changes can have on their daily life. Though there are never been so many young people in the world as now, they are a silent group in the planning process and the means to involve their perceptions in planning (Rekola and Paloniemi 2018). In fact, under a perspective of power distribution, there is no equal balance of youth considered as active stakeholders and their voices to ensure to be heard (Schon 1984). Understanding the perceptions and thoughts of young generations through participatory approaches for policy making can significantly enhance the quality of policy that are designed to better connect citizens to other stages of the supply chains, in this case analyzing critical points of the present and future supply chain.

2.4 Youth and food systems

Food system sustainability must be addressed as a whole and not as singular segments taken separately from each other (Hawkes et al. 2020). Shifting to sustainable food systems is a long process that entails efforts from all the population, giving rise to changes in daily habits that need to be designed following a bottom to top approach rather than a classic imposing approach (Anderson and Leach 2019). Youth engagement is of utter

importance in the food systems, where policy makers might address dimensions of policy that are specific to young generations or that may be affected by (Glover and Sumberg 2020). Young people are active in the food system by a multitude of factors and situations, in all steps of the supply chain, from production, to processing, wholesalers, retailers, distribution, catering and finally consumption. Agriculture shows the lowest generational turnover amongst young people, mostly due to a general attractiveness of the sector, unemployment, low technology, and low salaries (B. White 2020). Proceeding along the supply chain, young people are present in all the stages, and except when they are hired as workers, they are known to be trend setters in food systems, able for example to determine and change complex equilibrium with the power of social media (Khalid, Jayasainan, and Hassim 2018).

3 Methods

Due to the thematic of research, a combination of different methodologies was adopted. In the first steps of the research, literature on scenario development, youth engagement, and future foresight methodologies was reviewed to identify potential streams of research and potential methods to apply. Then, scenarios were developed for evaluation via focus groups of youth. Results from these focus groups were then analyzed through a software (NVIVO), to extrapolate participant-generated themes reflecting food supply chain sustainability indicators (Desiderio et al. 2021). Ultimately, these indicators were then tested through a survey (Figure 3).

Figure 3 Methodological flow

3.1 Scenario development

A set of different plausible scenarios has been collected through a literature review, conducted on the research engines Scopus, Web of Science, and Google Scholar, using the keywords “future food systems, scenario development, citizen engagement, social sustainability”. Table 9 reports the eligibility criteria.

Table 9 Eligibility criteria

Inclusion criteria	Exclusion criteria
Keywords: Future food systems Scenario development Citizen engagement Social sustainability	Secondary studies
Study published between 2010-2021	Duplicate studies
Primary studies	Non-English written papers
Peer-reviewed studies	

Scenarios were developed following the general procedure for combining qualitative and quantitative scenarios called the “story and simulation” (SAS) approach proposed by (Alcamo 2008). The qualitative storylines provide an understandable vehicle for communicating the messages of the scenarios and can express the more complex dimensions and interconnectedness of environmental problems as well as a consistency check between the different assumptions of the qualitative scenarios and the numerical data often needed in environmental studies.

3.2 Focus groups and protocol

Focus group are semi-structured discussions with groups of 4-12 persons that aim to explore a specific set of issues (Tong, Sainsbury, and Craig 2007). Focus groups allow participants to talk with one another, react to others’ responses, piggy-back ideas (Krueger 2000). This method is well suited for studies that leverage group dynamics to respond creatively or imagine future scenarios. The four scenarios developed through the literature review were submitted to the focus groups, composed by graduate students.

The focus groups took place following the designed protocol (Annex 1). A total of 50 university randomly selected students, divided in 5 groups with 10 students each, were invited to take part to the focus groups on the Microsoft Teams videochat platform. Participants belonged to both sexes, were between 21 and 30 years old and studied at the Alma Mater Studiorum University of Bologna at the Master's degree course "Local and Global Development" at the Department of Political Sciences and the three-year degree course "Economics and Marketing in the Agro-industrial System" at the Department of Agriculture and Food Sciences and Technologies. It was decided to conduct these debates in Italian, and in a two-hour span. Prior to the start of the meeting, students were asked for their permission to be recorded. First, the speaker introduced himself and briefly described the objective of the focus group, after which the students involved were given the opportunity to introduce themselves. Each scenario was described in 10 minutes to be followed by another 10 minutes debate.

3.2.1 Focus group analysis through NVIVO

The QSR International’s NVivo 12.0 program was chosen to analyse the focus groups results by its ability to elaborate large qualitative datasets in detail (Maher et al. 2018) and discover the most significant insights (Lei Li et al. 2022), identify relationships between results, and display concept maps. Focus groups results were collected, transcribed, made anonymous, and imported into the software, and analyzed. Thematic nodes were created following a deductive process using the Sustainability Assessment of Food and Agriculture Systems .(FAO 2014) and the three sustainability dimensions reported within the guidelines: environmental sustainability, economic sustainability, and food supply chain.

3.3 Survey

NVIVO results contributed to the creation of the online survey whose aim consisted in validating findings through a larger group of respondents. The survey inquired what is appealing in terms of sustainability and policies for young citizens, confirming or disagreeing with the previous interests' areas test whether they consider the indicators for the interest's area consistent and if policies match their needs. The survey aimed at testing the results found from the analysis of the focus groups, valuating the resulting themes and sustainability indicators that emerged from them. The survey was created on QualtricsXm (Annex 2), and consisted of five different sections: 1) introduction, with the purpose of the survey; 2) privacy consent form, 3) general demographic information, 4) approach to sustainability, 5) sustainability indicators. The survey was distributed via social media, to a convenience sample from the 1st of December 2021 to the 31st of December 2021, through cross-platform centralized instant messaging freeware WhatsApp and WeChat, and social networking services Facebook and Instagram. Respondents were contacted and invited to fill the survey through an anonymous link. The convenience sample is not a representative one since there is no control regarding the distribution of the survey. Despite this, this distribution channel was chosen as young people are quite comfortable with surveys promoted via social medias.

4 Results

4.1 Scenario development

The different scenarios analyzed through the literature review present similar traits, in general, four different scenarios have been proposed by each author (Table 8). One out of the four scenarios usually represent "business as usual" realities, in which no change is adopted in the current present of food systems. If current food systems are left unchanged, they may lead to an extreme consumption of resources, which could consequently make healthy food scarcely affordable. Different policies and actions on different aspects could instead make food systems much more sustainable than what they currently are.

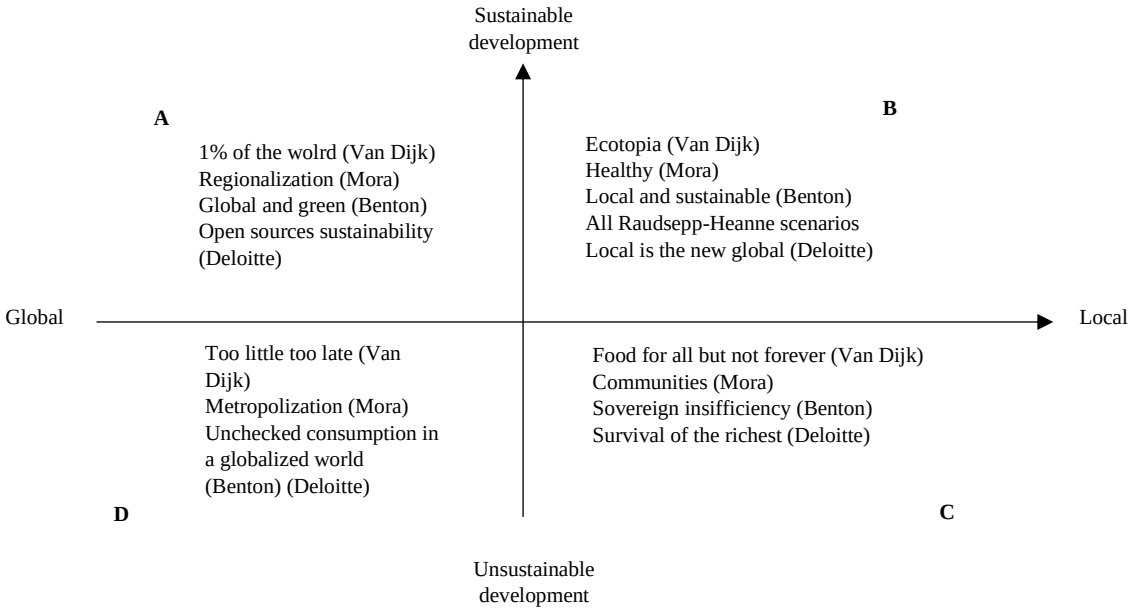


Figure 4 Food systems scenario matrix

Fig.4 shows the four future food systems scenarios (clockwise A,B,C, and D) obtained through the combination of the five papers selected through literature review and their position in the scenario matrix. The matrix displays the scenarios around two axes that underline two main dimensions chosen as opposites in creating the for areas. Sustainable development (correct use of natural resources) and its opposite, unsustainable one on axis y; local and global on the x axis, as a polar view of the world where policies, immigration and country development tend to one or another. The four dimensions were chosen based on the different elements that compose the scenarios by the author selected. The several elements and drivers that compose authors' future food systems scenarios were then combined to create more complete ones.

The elements that characterize the resulting scenarios are listed in Table 10.

Table 10 Scenarios' characteristics

Scenario	Climate change	Development, income, population, growth	Use of natural resources	Diet	Policies	International cooperation	Migration
A Global and sustainable	Low/moderate due to mitigation and adaptation technologies	Inequality increased between regions, high connectivity due to increased technologies, difficult generational turnover	Sustainable, but managed by elites, decrease in crop yields, sustainable intensification for cropping and livestock systems, intensive horticulture	Regional, medium meat,	Benefit for the elites	Strong between elites,	Medium
B Local and sustainable	Low due to mitigation and adaptation technologies, tendency to stabilize it	Reduced inequality between regions	Stable crop yield, sustainable use of resources, sustainable intensification of cropping systems and agroecology for livestocks	Low meat diet, healthy food diet, circular food systems, low FLW, focus on traditional diets	Benefit towards sustainable development	Strong between everybody	Medium
C Local and unsustainable	High due to lack of mitigation	Low population growth	Unsustainable use of natural resources, decrease in crop yields,	High meat diet, high FLW, regional	Benefit free market and growth	Low/medium, isolation policies,	High, from LICs to HICs

			low research in food systems and livestock, broad disparity of access and adoption	food diet,			
D Global and unsustainable	High climate change,	Medium population growth, income per capita low in all regions	Unsustainable use of natural resources, slow technical change, low yields,	Medium meat diet	Policies oriented towards free markets	High	High

4.1.1. Elitarian Society

Scenario A presents a future in which natural resources are sustainably managed by a global elite of few. Globalization and liberalization have allowed a few corporations to have rights on available resources, thanks to international cooperation treaties and an increase in technology. Far from being not plausible, nowadays corporations and investments funds are already known for purchasing large plot of soil around the world, specifically in strategic countries, like Africa. China, the U.S. and the U.K are listed as the major purchaser in these field (Seaquist, Johansson, and Nicholas 2014). From a food system perspective, climate change is averagely mitigated thanks to new technologies, which has widened the disparity amongst worldwide regions. Climate change has in fact already made poor countries poorer and rich countries richer (MIT 2019). Crop yields generally decrease and medium fluxes of migrants travel towards richer countries. The world is already witnessing this process since flows of environmental migrants are already moving from climate affected areas to safer ones, like in Africa (Abubakar et al. 2018; Balsari, Dresser, and Leaning 2020) Food systems are pervaded by technology too, which widen the intergenerational gap between young and old farmers.

4.1.2 Inclusive and environmentally friendly society

Scenario B society manages its resources with a sustainable approach, having implemented choices on different policies level that foster a local consumption attitude. This scenarios matches the worldwide objectives Governments are targeting through the development sustainable development agendas, such as the Sustainable Development Goals of Agenda 2030 (UN 2015). By managing natural resources in a sustainable way, opting for a controlled consumption, regenerative policies and the use of renewable energy sources climate change effects are lowered and mitigated. In fact, choosing a life that abides to an environmental friendly life could significantly reduce humans carbon foot print, considering that if the average per capita carbon foot print of Europe is 7.5tCO2 eq/cap a shift towards a car-free life or an electric car and reducing long haul flights would

reduce the citizens food print of 1.7 tCO2eq/cap (Ivanova et al. 2020). On a diet perspective this scenario is characterized by a low consumption of meat and food choices mostly based on short supply chains and seasonality. Global markets and international food trades suffer from policies that are fostering short supply chains, nevertheless the effort for shifting towards a sustainable development are undertaken thanks through a stable international cooperation.

4.1.3 Consumerist Closed Society

Scenario C is characterized by an unsustainable way of managing resources, and local distorted use of them due to an increase of nationalist oriented policies and a close up of countries. Like during the Soviet era, the overambitious URSS first Soviet five year plan, based on a centralized control of agricultural production, resulted in successes and failures, completely revolutionizing food system though (Hunter 1973). A lack of international cooperation undermines the free trade and makes food systems weaker. Global improvements in food and nutrition security under an open and inclusive trade regime have contributed to falling levels of undernourishment, better nutrition and greater dietary diversity, and overall economic development. Trade contributes to the four key requirements of food security—food availability, access, utilization, and stability of supply (Martin and Laborde 2018). Sovereign state controls markets, and the economic growth is slow. Diet is high in protein, mainly due to the high consume of meat where available and pulses otherwise. The unsustainable resources management has led to an intensification of animal feedstock, to overcome the shortage of others food sources.

4.1.4 Society 2021

Scenario D portraits a future with no positive traits at all, resulting in the most extreme outcomes, a consequential mirror of what could happen to actual society if current development and consumption pattern would be left unchecked. Up to know, each year a new record of natural resources consumption is reached, as in 2020, where 100 bn/ton of where used (Marlowe 2020) and only 8.3% of what is consumed is then reused again (CGRI 2020). Here resources are consumed at a quicker pace than their recover rate, there is no attention towards local development, but the world is dominated by only a small portion of people, those that have enough power to assert their influence on government, natural resources, and consequently food systems. Climate change is infuriating due to the lack of coordinated actions against it. Extreme weather phenomena, specifically in coastal areas, where 40% of the world population reside (UN 2017) causes the first waves of environmental refuges, that seeks shelter and a new life in safe cities. High rates of uncontrolled migration due to climate change disruptions accelerate phenomena of vast metropolitan areas, where civilians increasingly lose their contact with natural systems. A wide gap exists between urban and rural areas, which become even poorer. Diets are not equilibrated due to unstable food supplies and weak connections of supply chains.

4.2 NVivo qualitative analysis

The qualitative analysis conducted on the focus groups through NVivo resulted in 28 sustainability thematic areas, deductively derived from the SAFA guidelines, composed by nodes, gathering aspects that were pointed out as specific insights that participants have on future issues of the food systems, representing potential insights that can contribute to active consultative participation in policy making process (Head 2011). Below, in table 11, the 28 sustainability thematic areas are divided based on the pillar of sustainability they fall within.

Table 11 Sustainability thematic areas from focus groups, ranging from red (0 nodes), light green (5 nodes) to dark green (10 or >10 nodes)

Sustainability thematic areas	Focus group 1	Focus group 2	Focus group 3	Focus group 4	Focus group 5	Total nodes
Environmental sustainability						
Climate change	6	1	8	3	0	18
Economic sustainability						
Bargaining power	6	3	2	4	3	18
Purchase power	6	2	7	2	4	21
Resources monopoly	6	1	3	1	2	12
Sustainable trade	5	2	1	1	3	12
Food dependency	1	0	0	1	1	3
Food production	4	0	0	1	0	5
Food waste	1	0	0	1	1	3
Short supply chain	1	2	2	1	1	7
Traceability	7	3	1	2	2	15
Social sustainability						
Capacity development	2	1	0	1	3	7
Education	10	1	5	3	4	22
Governance	8	4	1	4	3	20
Bottom-up approach	5	2	0	1	3	11
Food policies	4	1	0	1	0	6
Media	1	0	0	1	0	2
Vulnerable groups	1	0	0	2	2	5
Income inequality	2	0	0	0	2	4
Social awareness	4	0	8	5	3	20
Social costs	6	0	0	0	1	7
Social gap	8	1	2	1	2	14
Social unrest	6	0	0	2	2	10
Stakeholders' engagement	8	0	0	4	1	13
Citizen engagement	3	0	5	6	2	16
Food awareness	3	0	6	3	2	14
Food habits	12	0	5	5	1	23
Sustainable consumption	7	0	7	4	0	18
Welfare	4	0	0	2	0	6

Social sustainability categories were the most coded, based on the content of the focus groups. This element confirms the thesis of the previous work "Social sustainability tools and indicators for the food supply chain: a systematic literature review" (Desiderio et al. 2022), confirming the discrepancy between citizens social sustainability needs and existing application. Regarding the environmental sustainability, youth expressed worries mainly of climate change aspects related to future food systems. On the economic side, bargaining power, purchase power, resources monopoly, sustainable trade, and food traceability picture a general concern regarding the potential role big companies and corporations could have in terms of influencing prices and supply of food products. It seems that the interest of the consumers would seemingly be jeopardized by the increasing presence of big industry in the market, that would in a way exercise a greater influence on the market therefore limiting what consumers' choice. Finally, social sustainability aspects were the most discussed were related to education, governance, social awareness, citizen engagement.

Table 12 reports the sustainability thematic areas with more than 15 nodes, to which indicators derived from both from the previous work by Desiderio et al. (2022) and from those suggested by the participants from the focus groups were connected. The resulting topic and their related coverage show where the real dialogue happened among young generations. Specifically, the topics that were felt as the most sensitive and in need of intervention from policy makers for boosting laws and good practices were: bargaining power, purchase power, climate change, governance aspects, social awareness, citizen engagement, traceability.

Table 12 Indicators to evaluate environmental, economic and social sustainability identified from focus groups

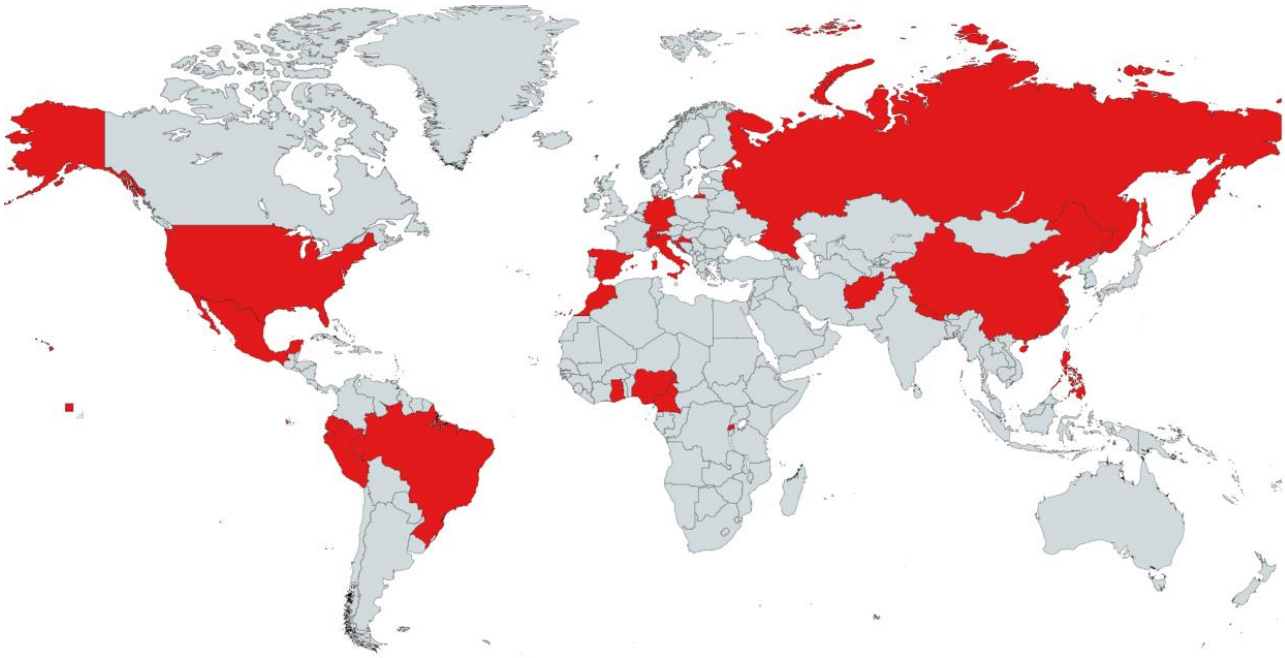
Sustainability dimension	**Sustainability thematic area**	**Indicators found**
Environmental sustainability	Climate change	% of ingredient coming from environmental friendly sources
Economic sustainability	Stakeholders bargaining power	Number of stakeholders association, Number of people within the association, Number of associations represented within a legislative structure, ratio Number of associations Number of people employed in the companies forming the association, monetary budget for specific stakeholder's support
	Stakeholders purchasing power	Number of fruit and vegetables portions consumed Number of organic shops per neighborhood Number of farmers market per neighborhood
	Food production	Future production sufficiency % of food independency
Social sustainability	Capacity development	Number of food producers with newly acquired knowledge by date x Number of information systems established by date New sector policy formulated by date Proportion of food producers applying knowledge to increase food production by date x

		Effective and regular information sharing mechanisms in place by date x Quality of new policy adopted or implemented by date
	Education	Skills development for informed decisions (Ratio food expenses/waste) Number of food awareness courses Number of seminars for school
	Media	Number of reports on sustainable agriculture
	Vulnerable groups	% of non-European citizens employed within the supply chain % of LGBT+ communities people employed within the supply chain or a stage
	Income inequality	Gender pay gap
	Social awareness	Number of advocacy groups per sector Number of advocacy groups per city
	Social gap	Income diversity between
	Social unrest	Number of strikes per year
	Stakeholders' engagement	Number of dialogue workshops Number of stakeholders round tables Number of community engagement planning initiatives

4.4 Survey

Five hundred and twenty-four respondents answered the online survey, 266 identified as male, 237 as female, 12 non-binary, and 19 preferred not to say. Fifty per cent belonged to the generation Z (born between 1997-2012), while the remaining 20% to generation Y (born between 1981-1996) and Baby boomers (1946-1964). Most of the respondents held at least a high school license and lived evenly dispersed from villages to metropolis located in Afghanistan, Brazil, Cameroon, China, Croatia, Ecuador, Germany, Ghana, Italy, Maldives, Mexico, Morocco, Nepal, Nigeria, Peru, Philippines, Russian Federation, Rwanda, Spain, Switzerland, and United States of America (Figure 5).

Figure 5 Survey geographical outreach



Concerning sustainability awareness, only 63% of respondents were aware of the SDGs proposed in 2015 and as per their rating of importance, SDG 2 (zero hunger), SDG 4 (quality education), SDG 13 (climate action), and SDG 15 (life on earth). Seemingly 60% of respondents knew about the Food Summit held in Rome in September 2021, and when asked to rate the priority of the actions promoted by the Food Summit, "increase the resilience to the vulnerabilities and stress of food systems" gained the highest votes. In terms of role within the food supply chain, 79% respondents identified as consumers, followed by 13% of producers. As concerned the thematic "representation within institutions," 77% of respondents preferred to be represented in terms of consumers rights by many and small industry associations. For what concerns the thematic "access to fresh food," 60% of respondents claimed that having access to farmers market within their living area is of great importance, followed by access to organic shops (24%), and food e-commerce services (18%).

For the social sustainability section of the survey, where the indicators were inserted within the questions and the choosing of policy priorities, 26% believed that the priority should be to increase the use of certifications that guarantee the sustainability of products, specifically in terms of worker rights. Promoting education courses that can help in increasing one own knowledge of foods follows. Finally, for the section regarding the satisfaction with the food systems in their own living context, the access to fresh food was overall satisfactory but not so much for the promotion of a local diet.

5 Discussion

Having insights from population increases the chances for policy makers to tailor decisions and rules according to the current needs of the population. The rationale behind the study aimed to define and test new food systems social sustainability indicators through youth engagement for informed and robust policy insights, to provide policymakers suggestions that would incorporate citizen's needs, specifically young generations ones. Through different methodological steps it was possible to build a discussion with young people on future food systems that contribute to create the structure of the survey and the indicators tested within it. The survey was not a representative one since it did not represent an exact replica of a population, it had though an international outreach of mainly young people, that could validate and express and opinion on the focus groups of their peers.

Since the main focus of this research is based on the needs of future generations, results are broken out based on the generation interviewed belong to. The study demonstrates a correlation between belonging to a young generation and the need of action regarding environmental issues. Climate change poses in fact an urgent threat to future generations and youngsters are more susceptible to its effects than adults, with immediate and lifelong impacts on their physical and mental health (Sanson, Van Hoorn, and Burke 2019). The analysis supports the Community Dissonance Theory, proving a discrepancy in terms of representativeness within policy frameworks and the difference of needs when results are breaking out. SDG 13 (climate action) priority is in fact given a higher rate in correlation with belonging to younger generations. The same correlation trend happens for SDG 4 (Quality education), which was indicated as top priority as age decreased.

5.1 Data acquiring and processing uncertainties and limitations

The paper represents a novelty in the field of citizen contribution to policy insights since through the methodology applied, that comprehend focus groups, future foresight, qualitative analysis, and survey, it has allowed to gain key knowledge of what the citizens believe to be top priority to address in terms of future food systems. The combination of methodologies seems to be valid to capture population need based on their age, gender, origin, although some research limitations were encountered. Regarding the sample size and profile, further investigations it would be necessary to submit it to a larger sample for more robust results. The initial students sample interviewed in the focus groups was easily accessible for data collection, nonetheless, other including young workers or NEET (Neither in Employment or in Education or Training) could broaden the spectrum of perceptions, widening the possibility to get useful insights. Regarding the data collection process, despite the focus groups have been recorded, their translation in English from Italian may have caused the loss of some material. For what concern the online survey and the survey collection, the utilization of QualtricsXm has guaranteed control over the process without the risk of losing any data. Similar methodologies have been proposed and applied also by the OECD (OECD 2019) for their proved effectiveness in scoping policy problems on a society level. In general, literature confirms that mixed methodologies of this kind contribute to

modelling determinants, influencing factors and direct drivers of future food system within a citizen science framework (van den Berg et al. 2019).

5.2 Indicators

The new indicators that have been brought forth by citizen regards fell within the economic and social sustainability domains of future food systems, in minor part to the environmental one. In terms of food access, the new indicators consist of *access to food e-commerce services, access to organic shops, access to farmers market*. Generation Z (1997-2012) respondents preferred to have guaranteed access to farmers market, confirming previous data on their need of policies that demand radical change from the food sector to tackle access to healthy and affordable food (EIT Food 2019). Generation Y (1981-1996) respondents wanted food e-commerce services (Glover and Sumberg 2020).
In terms of social sustainability, indicators that were confirmed regard *% of foreign citizens employed, salary differences by gender gap,* and *number of strikes per year*. New indicators proposed are *number of events, tools, platforms to promote dialogue between different stakeholders, number of food education courses,* and *presence of sustainability certification of food origin.* In general, there is an agreement in requesting labels on food products that can guarantee the sustainability of the ingredients in terms or origins, labor employed, environmental impacts. Despite this, youngest generations (especially those that claimed to be consumers within the supply chain) call for the introduction of food education courses, that can educate people towards sustainable purchases, raising awareness on sustainability issues, traceability, and food waste. Examples of such courses are for now only found as study subjects in Universities, though they have promising results in raising sustainability awareness (Blodgett and Feld 2021). Increasing the integration of non-European citizens within the supply chain was mildly addressed by the different categories, although not emphatically as previous social aspects. In general, other social elements that called for an intervention consisted of protecting commodities and food prices by the influences of big size companies and lobbies, shortening the supply chain, with particular emphasis on redistributing economic value amongst the stakeholders involved, reducing food waste, and improving payments.

Realizing the full potential of citizen contributions depends on creating an enabling environment of support. This research highlights the potential of using citizens to assess the processes and results of policy priorities, which could constitute a monitoring process for the acceptance of specific tools, measure, laws, interventions proposed by policies. Understanding new indicators on existing data sources to measure practices, as well as the data gaps, can be an important step forward in ensuring appropriate use of citizen science recourse. The greatest contributions of citizen engagement are in this case the social domain, which makes sense since given that population generally perceives is highly focused on society needs. This work is relevant for policy making since it confirms social sustainability indicators, identifies new ones, and provides feedback on what people would like policy makers to intervene on.

6 Conclusion

In this paper, we defined and tested new food systems social sustainability indicators through youth engagement for informed and robust policy insights, to provide policymakers suggestions that would incorporate citizen's needs, specifically young generations ones. We conclude that a meaningful way to create a process to directly involve society within policy making process consists in combining different methodologies that represent a specific context, in this case future food systems, and the drivers that could influence life-style changes. Combining these elements with further and broader use of surveys, allowed us to identify priorities in terms of policy interventions, indicators that mirror the many aspects population would want a direct policy priority. From the literature, little research has been conducted on from previous researchers on population needs in terms of future food systems, since it is more usually a subject dealt by private companies within an optic of product. Despite this, this research confirms the recent years youth movement call for action in terms of climate action. What this research add to the literature is an innovative methodology that capture the need of current and future generations and shows where future decision should focus more. In terms of future food systems, on a social perspective, young generation require from policy makers an intervention on the education aspects that could foster consumers sustainability awareness, easing a bottom-up transition towards more sustainable production and consumption.

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CONCLUSIONS

This research contributes to the identification of existing social and economic indicators for the stakeholders involved in the supply chains and provides new ones for future food systems proposed by young generations for robust policies insights. What emerges from the work is a complete review of social sustainability indicators for the whole supply chain, and a lack of social , an partly economics, indicators from the consumer perspective, and a final integration of these through civil consultations. The outcome of this study reveals that in terms of social and economic sustainability indicators for the supply chain, only few of them exist for the central stages of the supply chains stages such as wholesalers, and that consumers have a great power in influencing social and economic aspects. For this reason, the outcome of the second work explored these last aspects, providing new social and economic indicators that unveil citizen priorities, which are mainly focus on the integration of minorities within the supply chain, protection of small producers through a just representiveness on local authorities' level, more access to farm market and fresh food. Lastly, the work contribute to provide potential social and economic indicators that underline possible areas on intervention in terms of policies.

A first aim of this research was to identify the current state of art of how social sustainability aspects are measured through various tools and indicators, addressing three research questions: (1) assessing how the scientific literature on social sustainability regarding food supply chains has evolved in recent years, (2) identifying the established and proposed tools used to assess it, and (3) delineating the main indicators that can contribute to achieve this aim.

Starting from a definition of indicators and tools and framing the context of the research focusing on the food supply chain, intended as a sequence of steps and actors that produce, transform, sell and consume food products, study applied a systematic literature research, adopting a replicable process performed according to standards set by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, being an established and robust method for conducting such analysis. The analysis of databases reported 101 documents for a total of 34 tools, whose availability tend to decrease as proceeding from producers (17) tools, processing stage (5), wholesale (4), retail (2) and consumer (2). Wholesaler stage in terms of tools and indicators appear to be a bottleneck in regards to social sustainability, being the least connected stage of the supply chain, despite being in certain food supply chain the one that control markets supply.

The second aim was to define and test new food systems social and economic sustainability indicators through youth engagement for informed and robust policy insights, to provide policymakers suggestions that would incorporate citizen's needs, specifically young generations ones.

Starting from the definition of four future food systems scenarios that embody four different directions in terms of sustainability and resources consumptions food systems may adopt, focus groups were organized involving young students to understand their perspective on them. The resulting outcomes, after being coded, provided the baseline for the survey design, which tested through a wider audience the resulting social and economic sustainability indicators. Results shows how young generations wanted social indicators such as minorities inclusion, gender pay gap to be included in food systems policies, confirming the results from the previous

work, Moreover, new indicators such a presence of food market, access to food e-commerce resulted as new food security indicators brought forth by the focus groups that young generations sought to be included in policies.

Methodological developments

The methodologies chosen in the first and the second chapter have allowed to understand the current state of social sustainability indicators and tools for the supply chains, and secondly to identify social, economic and environmental indicators for future food systems provided by young generations. For the first work, the application of the PRISMA guidelines for the systematic literature review has revealed hotspots in terms of lack of indicators and where bottlenecks may occur. The first work is one of the few examples of research that has been taken into consideration each stage of the supply chain, and adopting the SLCA guidelines, it was possible include in the analysis the exact stakeholders belonging to specific supply chain stages. Within the second work, the adoption of mixed methodologies have allowed to focus on thematic areas and indicators that have directly been proposed by members of civil society, in this case youth rarely considered an approach to the whole food supply chain, with particular emphasis to the consumers and citizen stage. Nevertheless, the number of indicators that were found can bring little knowledge on the status of sustainability if not compared or verified. As indicators are not sufficient by themselves, the second work methodologies, apart from defining new ones, tested them with a wider audience, to understand which ones should be integrated in future food systems policies. An iterative mixed-methods approach was used to develop a methodological framework based on: focus groups, qualitative analysis by NVivo, and an online survey. These were able to capture produce a robust sequence to transform citizens', and specifically young ones, perspectives, ideas, feelings and needs into sustainability insights for policies that mirror real needs of the population. As different social theories claim the gap that exist between citizens and policy makers, so between who receives laws and who makes them, the second work aimed at filling this gap within the field of future food systems. Focus groups have been used by public and private entities to capture and identify the nuances in people preferences, but rarely in order to test whether some policies regulations were the right ones and how they were perceived by consumers, but rather to create involve them in the process of making. The active involvement of citizens as source of data, through the engagement of nonscientists in true decision-making about policy issues that have technical or scientific components, in the second work was driven by the results of the first work, which underlined the influence of consumers in terms of supply chain. An important step to improve the quality of indicators within policies is in fact to understand the magnitude of their needs and the areas of intervention that should follow. NVivo allowed for deductive coding of focus groups results, providing several sustainability thematic areas that were then turned into social and economic indicators. Social aspects resulted as the most discussed ones by focus groups participants, followed by economic and environmental. Finally, the online survey allowed to reach out hundreds of respondents, which contributed to the confirmation of focus groups results.

A complementary aspects of policy design could follow a bottom-up approach, aiming at creating an interconnected system of shared knowledge, know-how, and practices that can boost sustainable solutions across all supply chain stages, engaging citizen play a fundamental role. At the same time, the ability to access and share knowledge is a prerequisite for people and communities to participate in key-decision making processes related to their food systems. Food democracy is a process to get a just food system, i.e. bottom up, transversal and inclusive, addressing food insecurity due to different patterns of discrimination, improving access to affordable healthy food for all citizens. Especially within public institution, citizens opinions is rarely taken into account when designing policies, utterly true for young generations. The recent years environmental movements pivoted by young generations, call for a deep change of our consumption patterns, which should meet the interest of policy makers in channeling these needs and priorities into real policy actions. The social impacts of these preferences and needs in term of food systems and food supply chains meets the political need to adopt new and stronger governance mechanisms aimed at improving the effectiveness of sustainable food systems thorough integrated and holistic policies.

Research to policy

The methodology proposed raises the attention regarding the possibilities to be applied firstly to identify social and economic gaps in terms of indicators and tools within the supply chain, and secondly, to solve generational needs through policies. The mixed methodology approach proposed in the work raises the knowledge about social and economic needs for the current and future supply chain stakeholders, providing indicators that can help to understand the needs of several generations, framing them within future food systems. The analysis on the supply chain reveals a lack of equilibrium in terms of indicators availability, especially for those stages that can very easily influence the whole supply chain, like wholesalers. At the same time, it confirms the greate influence consumers have on it, which laid the foundation for deepening the topic within the perspective of young generations. On a policy perspective, strategically identifying the would-be users of future food systems policies would lead to an increase of understanding of which are the right indicators to chose which would guarantee representativeness within policies. Within this work, specific indicators such as access to food e commerce services, access to farmers markets, sustainability food labels, may be helpful for policymakers to shape specific policies in areas where there is a majority of young people, i.e. colleges or universities.

Limitations and further research

Concerning the systematic literature review, research limitations reside for the first work within the material collected, as most of it derived by peer reviewed journals, and only a minor percentage from companies report. This is probably due to the different approach in releasing data certain companies have, or in general the possibility to pay for an external agency to perform sustainability analysis for reporting purposes. Data and report availability from private companies of different size, geographic location and revenues could certainly enrich the availability of social sustainability tools and indicators. As concerned the second work, the sample of people that took the survey was not representative since the distribution of the survey was not submitted to

representative people that could embody society. Although this may seem like a barrier, it is actually in line with the rationale behind the study of testing the online survey to a wider audience of young people, which are used to take online surveys.

Further research could investigate how the metrics within the indicators defined, and comparing business as usual scenarios with future food systems scenarios, assessing how much the presence or absence of these indicators could make a difference in terms of sustainability. Moreover, in terms of policies, a cross check could be made to assess if the indicators defined through the work are present on a legislative level.

ANNEXES

ANNEXES CHAPTER 1

Table 13 Literature review covered to identify the proposed tools an indicators

Food supply chain stage	Author	Article title	Year	Framework/tool used	Stakeh. farmers indicators	Stakeh. workers indicators	Stakeh. society indicators	Stakeh. consumers indicators
1) Production	Chongyang,D.; Dias, L.; Fausto, L.	Robust multi-criteria weighting in comparative LCA and SLCA: a case study of sugarcane production in Brazil	2018	**SLCA, LCA**	Health and safety Local employment Fair salary Access to material resources Delocalization and migration Public commitment to sustainability issues Safe and healthy living conditions Equal opportunity and discrimination	/	/	/
Food supply chain stage	**Author**	**Article title**	**Year**	**Framework/tool used**	**Stakeh. farmers indicators**	**Stakeh. workers indicators**	**Stakeh. society indicators**	**Stakeh. consumers indicators**
1) Production	Pottiez, E.; Lescoat, P.; Bouvareal, I.	AVIBIO: a method to assess the sustainability of the organic poultry industry.	2012	**Avibio (AVIcuture BIOlogique)**	/	/	Ensure the sustainability of production tools Strengthen the local network	Meet citizens' expectations
1) Production	Committee on sustainability assessment of Philadelphia	The COSA Measuring Sustainability Report: Coffee and Cocoa in 12 countries	2013	**COSA (Committee On Sustainability Assessment)**	Health and Safety Living conditions Labor rights Education Gender Food Security Participation Transparency Capacity and Finance Social situation	/	/	/

Food supply chain stage	Author	Article title	Year	Framework/tool used	Stakeh. farmers indicators	Stakeh. workers indicators	Stakeh. society indicators	Stakeh. consumers indicators
1) Production	OECD	Environmental Indicators for Agriculture. Methods and Results. Organization for economic Co-operation and Development	2001	**DSR (Driving Force State Response)**	Farm employment Farmer age/gender distribution Farmer education Number of farms Agricultural support	/	/	/
1) Production	Tzilivakis, J.; Lewis, K.A.;	The development and use of farm-level indicators in England	2004	**FARMSMART**	Age of farmers Agricultural employment Knowledge of codes of practice			
1) Production	Zahm, F.; Viaux,P.; Vilain, L.; Girardin, P.; Mouchet,C.; 2008	Assessing farm sustainability with the IDEA method-from concept of agriculture sustainability to case studies on farms.	2008	**IDEA (Indicateur de Durabilitè des Exploitations)**	Ethics Local development Citizenship Human development Quality of life Employment Animal well being			
1) Production	Rigby, D.; Woodhouse, P,; Young, T.; Burton, M.	Constructing a farm level indicator of sustainable agricultural practice.	2001	**ISAP (Indicator of Sustainable Agricultural Practice)**	Quality of life Farmers authonomy Equity			
1) Production	Lopéz-Ridaura, S.; Keulen, H.V.; Ittersum, M.K.; Leffelaar, P.A.	Multiscale methodological framework to derive criteria and indicators for sustainability evaluation of peasent natural resources managament systems	2005	**MESMIS (Framework for Asessing the Sustainability of Natural Resource Management)**	Secure self-sufficiency Women empowerment Diversity Health Security Effectiveness Existence Freedom of action Co-existence		Rural communities autonomy	
1) Production	Lopéz-Ridaura, S.; Keulen, H.V.; Ittersum, M.K.; Leffelaar, P.A.	Evaluating the sustainability of complex socio enviromental systems. The MESMIS framework.	2002	**MESMIS (Framework for Asessing the Sustainability of Natural Resource Management)**	Secure self-sufficiency Women empowerment Diversity Health Security Effectiveness Existence Freedom of			

Food supply chain stage	Author	Article title	Year	Framework/tool used	Stakeh. farmers indicators	Stakeh. workers indicators	Stakeh. society indicators	Stakeh. consumers indicators
					action Co-existence			
1) Production	Gerrard,C.; Smith,L.G.; Pearce, B.; Padel, S.; Hitchings, R.; Measures,M.	Public good and farming, farming for food and water security.	2012	**PG (Public Goods Tool)**	Animal health	Workers health and safety	Employment Skills and knowledge Community engagement CSR initiatives Public access	
1) Production	Hani, F.; Braga, F.; Stampfli, A.; Keller T.; Fischer, M. Porsche, H.	RISE, a tool for holistic sustainability assessment at the farm level.	2003	**RISE (Response-Inducing Sustainability Evaluation 2.0)**	Seasonal labour	/	Immigration legislation Rural infrastrcutures	
1) Production	FAO	Sustainability Assessment of Food and Agriculture Systems Guidelines.	2013	**SAFA (Sustainability Assessment of Food and Agriculture systems)**	Quality of Life Fair Access to Means of Production Responsible Buyers Rights of Suppliers Employment Relations Forced Labour Child Labour Freedom of Association Non Discrimination Gender Equality Support to Vulnerable People Health Provisions Public Health Food Sovereignty	Workplace Safety Right to Bargaining	Indigenous Knowledge Capacity Development	/
1) Production	Van Cauwenbergh, N.;Biala, K.; Bielders, C.; Brouckaert, V.	SAFE-A hierarchical framework for assessing the sustainability of agricultural systems.	2007	**SAFE (Sustainability Assessment**	Physical well-being of the farming community function Psychological well-being of the farming community function	/	Food security and safety Production function acceptabilityWell-being of the society function	Information function

Food supply chain stage	Author	Article title	Year	Framework/tool used	Stakeh. farmers indicators	Stakeh. workers indicators	Stakeh. society indicators	Stakeh. consumers indicators
1) Production	Sawaengsak, W.; Olsen, I.S; Hauschild, M.Z.; Gheewala, S.H.	Development of a social impact assessment method and application to a case study of sugarcane, sugar, and ethanol in Thailand	2019	**SLCA**	Land rights Labor shortage High cost/low income of production Employment Training for health and safety Labor condition Access to knowledge Facility resource Fair wage and income Land tenure	/	/	/
1) Production	Fair Trade International	Fairtrade Standard for Smallscale Producer Organizations	2019	**Standards**	Labour Conditions Freedom from discrimination No discrimination No tests for pregnancy, HIV/AIDS or genetic disorders No abuse of any kind No tolerance of Gender Based Violence and other forms of violence Freedom from forced or compulsory labour No forced labour Freedom for spouses No children under 15 years employed Freedom of association and collective bargaining Conditions of employment Occupational health and safety			

Food supply chain stage	Author	Article title	Year	Framework/tool used	Stakeh. farmers indicators	Stakeh. workers indicators	Stakeh. society indicators	Stakeh. consumers indicators
1) Production	USAID	Gender Integration Framwork- Women Empowering in Agriculture	2019	**GIF**	Decision making indicator Training for women farmer group leadership roles held by women Hours women work Hours dedicated to specific tasks Measure of women savings			
1) Production	Marijke Meul, Steven van Passel, Frank Nevens, Joost Dessein, Elke Rogge, Annelies Mulier, Annelies van Hauwermeiren	MOTIFS: a monitoring tool for integrated farm sustainability	2008	**MOTIFS**	social inclusion housing income health labor good working conditions services facilities			
1) Production	Maria Luisa Paracchini; Claudia Bulgheroni; Giorgio Borreani; Ernesto Tabacco; Alessandro Banterle; Danilo Bertoni; Graziano Rossi; Gilberto Parolo; Roberto Origgi; Claudio De Paola	A diagnostic system to assess sustainability at farm level: the SOSTARE mode	2015	**SOSTARE**	leisure time farm continuity valorisation of short supply chains training farm income family labour farm diversification			
1) Production	Gaviglio, A.; Bertocchi, Mattia; Demartini, E.	A Tool for the Sustainability Assessment of Farms: Selection, Adaptation and Use of Indicators for an Italian Case Study	2017	**4Agro**	Livestock management Associations and social implications Cooperation Education	Sustainability of the employment Training	Rural buildings Landscapes and territory	Quality of the product Short food supply chain Related activties
2) Processing	Martucci, O.; Arcese, G.; Montauti, C.; Acampora, A.	Social aspects in the wine sector: comparison between social life cycle asessment and VIVA sustainable wine project indicators	2019	**SLCA, VIVA (framwork)**	/	Fair competition Promoting CSR Suppliers relationship Working conditions Fair salary Social benefit Equal opportunities	Local employment Technology development Contribution to economic development Community engagement	Consumer privacy

Food supply chain stage	Author	Article title	Year	Framework/tool used	Stakeh. farmers indicators	Stakeh. workers indicators	Stakeh. society indicators	Stakeh. consumers indicators
2) Processing	Elsaesser, M.; Hermann, K.; Boonen, J.; Debruyne	Quantifying sustainability of dairy farms with the DAIRYMAN sustainability index	2015	**DSI (Dairyman Sustainability Index)**				
2) Processing	Amel Bouzid, Martine Padilla	Analysis of social performance of the industrial tomatoes food chain in Algeria	2014	**SLCA**		Employees age Workforces working conditions Working hours Industrial accidents Social security Distance between home and the place of work Freedom of association		
2) Processing	Rivera Huerta,A.; De La Salud Rubio Lozano, M.; Padilla-Rivera,A.; Guereca, L.P.	Social sustainability asessment in livestock production: a social life cycle asessmenet approach	2019	**SLCA**	/	Human rights Child labor Freedom of association and collective Equal opportunities and discrimination Health and safety Fair salary Working hours Forced labor Job satisfaction	Local employment Technology development Contribution to economic development Community engagement	
2) Processing	Sawaengsak, W.; Olsen, I.S; Hauschild, M.Z.; Gheewala, S.H.	Development of a social impact assessment method and application to a case study of sugarcane, sugar, and ethanol in Thailand	2019	**SLCA**	/	Labor rights Quality of life Health and safety Non-discrimination Forced labor Child labor Gender equality Quality of life Capacity development Fair access to means of production Workplace safety and health provisions	/	
2) Processing	Anna Woodhouse; Jennifer Davis; Caroline Pénicaud; Karin Östergren	Sustainability checklist in support of the design of food processing	2018	**PRESERF Checklist**	/	Working conditions Workers knowldge Creation of new jobs	/	

Food supply chain stage	Author	Article title	Year	Framework/tool used	Stakeh. farmers indicators	Stakeh. workers indicators	Stakeh. society indicators	Stakeh. consumers indicators
2) Processing		FOOD PROCESSING SECTOR DISCLOSURES		**GRI**	Investment Non-discrimination Freedom of Association and Collective Bargaining Child Labor Forced or Compulsory Labor Security Practices Indigenous Rights Assessment Supplier Human Rights Assessment Human Rights Grievance Mechanisms	Employment Labor/Management Relations Occupational Health and Safety Training and Education Diversity and Equal Opportunity Equal Remuneration for Women and Men Supplier Assessment for Labor Practices Labor Practices Grievance Mechanisms	Local Communities Anti-corruption Public Policy Anti-competitive Behavior Compliance Supplier Assessment for Impacts on Society Grievance Mechanisms for Impacts on Society Healthy and Affordable Food Animal Welfare	Customer Health and Safety Product and Service Labeling Marketing Communications Customer Privacy Compliance
3)Wholesaler	Kalleitner-Huber, M.; Schweighofer, M.; Sieber, W.;	How to shift 100,000 products toward sustainability: Creating a sustainable assortment at Haberkorn.	2012	**Screening tool**	/	Working conditions	/	/
3)Wholesaler	Morganti, E.	Urban food planning, city logistics and sustainability: the role of the wholesale produce market. The cases of Parma and Bologna food hubs.	2011	**Systematic literature review**			Capacity to supply a city with the quantity Variety and quality of food products required by the urban consumers	
3)Wholesaler	Peter Jones, Daphne Comfort , David Hillier	European Food and Drink Wholesalers and Sustainability	2017	**CSR**		Employee orientation	Social aspects as part of all entrepreneurial decisions and processes	Product responsibility
3)Wholesaler	Antônio André Cunha Callado, Lisa Jack	Relations between usage patterns of performance indicators and the role of individual firms in fresh fruit agri-food supply chains	2017	**SCPM (Supply chain performance measurement)**	/	Employee motivation Employee capability Employee satisfaction		Cistomer satisfaction Customer loyalty Responsviness to clients

Food supply chain stage	Author	Article title	Year	Framework/tool used	Stakeh. farmers indicators	Stakeh. workers indicators	Stakeh. society indicators	Stakeh. consumers indicators
4)Retail	Walmart Stores Inc	Walmart Corporate Social Responsibility	2019	**CSR**	Standards for suppliers Clarifying expectations with suppliers Investing in research to understand prevalence of human rights violations and track progress toward improvement Engaging with governments to advocate for laws regulations and enforcement Collaborating with key stakeholders and thought leaders in task forces and consortia Building capacity in critical parts of the system (e.g., responsible recruitment, worker communication tools and monitoring technology)	Inclusive sourcing Treating workers with respect Promoting a safe & healthy work environment Providing a fair & inclusive work environment Combating forced & underage labor	Responsible supply chains Providing safer, healthier food & other products Responsible sourcing Global ethics	

Food supply chain stage	Author	Article title	Year	Framework/tool used	Stakeh. farmers indicators	Stakeh. workers indicators	Stakeh. society indicators	Stakeh. consumers indicators
4) Retail	Target Corporation		2019	**CSR**	Competitive wages and benefits Materials and packaging Net-positive manufacturing Supplier diversity Supply chain management Worker well-being	Competitive wages and benefits Diverse and inclusive workforce Environmental and social impacts Philanthropy Team member to team member support Worker well-being	Community engagement Economic opportunity Environmental impacts Materials and packaging Philanthropy Safety, preparedness and response Supply chain management Workforce development	Better products Community engagement Diverse and inclusive products and marketing Materials and packaging Supply chain management
4) Retail	Antônio André Cunha Callado, Lisa Jack	Relations between usage patterns of performance indicators and the role of individual firms in fresh fruit agri-food supply chains	2017	**SCPM (Supply chain performance measurement)**		Managers' level of education Managers' professional experience		
5) Consumer	Phuong-Mai Nguyen; Nam D. Vo; Nguyen Phuc Nguyen; Yongshik Choo	Corporate Social Responsibilities of Food Processing Companies in Vietnam from Consumer Perspective	2019	**SEM (structural equation modelling)**				Education Age Gender Income Religion Race Ethnicity Culture

Food supply chain stage	Author	Article title	Year	Framework/tool used	Stakeh. farmers indicators	Stakeh. workers indicators	Stakeh. society indicators	Stakeh. consumers indicators
5) Consumer	Hartmann, M.	Corporate social responsibility in the food sector	2018	**CSR**		Employee company identification Employee company commitment Employee company loyalty Company's general attractiveness Empoyee willingness to accept lower wages Employee perceived orgaization support Employee work satisfaction		Attitude/evaluation/reputation of company or brand Credibility of the company Product evaluation Insurance factor Consumer-company identification Consumer or customer loyalty Consumer trust Consumer satisfaction Product purchase intention
5) Consumer	Petti,L.; Serreli, M.; Di Cesare, S.	Systematic literature review in social life cycle assessment	2018	**CSR**			Community engagement	
5) Consumer	Venkatesh, G.	Critique of selected peer-reviewed publications on applied social life cycle assessment: focuse on cases from developing countries	2019	**CSR**				Consumer privacy
5) Consumer	Luchetti, M.C.; Arcese, G.; Traverso,M.; Montauti, C.	SLCA applications: a case studies analysis	2020	**CSR**		Company brand attractivness		

Table 14 Number of indicators per food supply chain stage and stakeholder

	Farmers	Workers	Society	Consumers	Total
Production	92	3	10	6	111
Processing	8	46	14	4	72
Wholesaler	0	5	3	4	12
Retailer	11	12	9	5	37
Consumers	0	6	0	11	17
Total	111	72	36	30	249

Figure 6 Bar chart repoting a graphic representation of indicators per food supply chain stage and stakeholder.

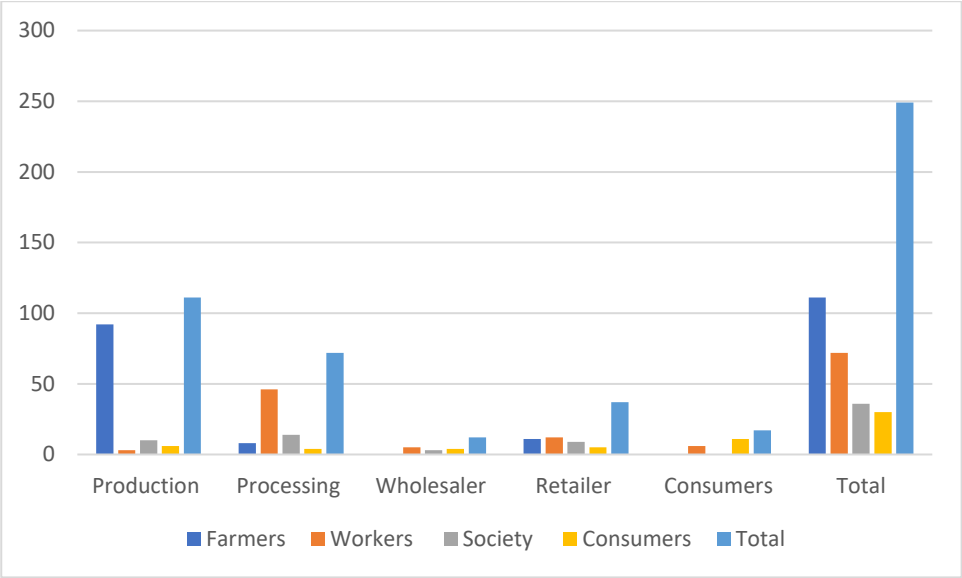

Table 15 Detailed indicators per food supply chain stage and stakeholders

Row Labels	Farmers	Workers	Society	Consumers	Grand Total
Production	**92**	**3**	**10**	**6**	**111**
Access to knowledge	1				1
Age	2				2
Animal well being	3				3
Capacity development			2		2
Child labor	2				2
Citizens expectation				1	1
Citizenship	1				1

Codes of practice	1				1
Community engagement			1		1
Delocalization	1				1
Discrimination	3				3
Diversity	2				2
Education	3				3
Employment	4				4
Equal opportunity	1				1
Equity	1				1
Ethics	1				1
Fair salary	2				2
Farmers authonomy	1				1
Food security	1		1	1	3
Forced labor	2				2
Freedom of action	2				2
Freedom of association	3				3
Gender equality	4				4
Health	5	1			6
Human development	1				1
Income	1				1
Indigenous knoledge			1		1
Information function				1	1
Labor diversification	1				1
Labor rights	4				4
Land rights	2				2
Living conditions	1				1
Local development	1				1
Local employment	1				1
Local network			1		1
Migration	1				1
Participation			1		1
Physical and psychological well being	1				1
Policy support	1				1
Privacy protection	1				1
Product quality				1	1

Production cost	1				1
Public access			1		1
Public commitment	1				1
Quality of life	3				3
Resource access	4				4
Rural buildings			1		1
Rural communities authonomy			1		1
Safety	2				2
Seasonal labor	1				1
Security	2				2
Self sufficiency	2				2
Social inclusion	1				1
Social situation	1				1
Training	2	1			3
Transparency				1	1
Valorisation of short supply chain	1			1	2
Well being	1				1
Women empowerment	3				3
Women savings	1				1
Workplace safety	3	1			4
Processing	**8**	**46**	**14**	**4**	**72**
Accidents		1			1
Age		1			1
Animal well being			1		1
Capacity development		1			1
Child labor	1	2			3
Collective bargaining	1				1
Community engagement			2		2
Consumer privacy				1	1
Contribution to economic development			1		1
Corruption			1		1
Creation of new jobs		1			1
Customer privacy				1	1
Discrimination	1	1			2
Distance between home and the plave of work		1			1
Diversity		1			1

Economic development			1		1
Education		1			1
Employment		1			1
Equal opportunity		3			3
Fair competition		1			1
Fair salary		1			1
Forced labor	1	2			3
Freedom of association	1	2			3
Gender equality		2			2
Health		3		1	4
Human rights	1	1			2
Indigenous rights	1				1
Investments	1				1
Job satisfaction		1			1
Labor rights		1			1
Local employment			2		2
Promoting CSR		1			1
Public policy			1		1
Quality of life		2			2
Resource access		1			1
Rural communities authonomy			1		1
Safety		3		1	4
Social benefit		1			1
Social security		1			1
Standards compliance			1		1
Suppliers assessment for impacts on society			1		1
Suppliers relationships		1			1
Technology development			2		2
Training		1			1
Workers knoledge		1			1
Working hours		2			2
Workplace safety		4			4
Wholesaler		**5**	**3**	**4**	**12**
Customer loyalty				1	1
Customer satisfaction				1	1
Employee capability		1			1

Employee motivation		1			1
Employee orientation		1			1
Employee satisfaction		1			1
Food security			1		1
Product quality				1	1
Responsivness to clients				1	1
Social aspects			1		1
Valorisation of short supply chain			1		1
Workplace safety		1			1
Retailer	**11**	**12**	**9**	**5**	**37**
Capacity development	1				1
Community engagement			1	1	2
Competitive wages	1				1
Diverse and inclusive products and marketing				1	1
Economic opportunity			1		1
Environmental impacts			1		1
Equal opportunity		1			1
Fair tratment		1			1
Food security			1		1
Global ethics			1		1
Inclusive sourcing		2			2
Local government	1				1
Magager professional expertise		1			1
Managers training		1			1
Materials and packaging	1		1	1	3
Physical and psychological well being		1			1
Product quality				1	1
Research	1				1
Responsible supply chains			1		1
Stakeholders collaboration	1				1
Standards compliance	1				1
Supplier diversity	1				1
Suppliers expecations	1				1
Supply chain management	1			1	2
Team building		1			1
Workers training		1			1

Workers well being	1	1			2
Workforce development			1		1
Workplace safety		2	1		3
Consumers		**6**		**11**	**17**
Company attitude				1	1
Company brand				1	1
Company credibility				1	1
Company general attractivness		1			1
Company reputation				1	1
Consumer company identification				1	1
Consumer satisfaction				1	1
Consumer trust				1	1
Customer loyalty				1	1
Employee company identification		1			1
Employee company loyalty		1			1
Employee perceived organization support		1			1
Employee work satisfaction		1			1
Employeee compnay committment		1			1
Insurance factor				1	1
Product evaluation				1	1
Product purchase intention				1	1
Grand Total	111	72	36	30	249

ANNEXES CHAPTER 2

ANNEX A Protocollo per Focus Groups:

ITALIAN VERSION

: testare indicatori di sostenibilità sociale basandosi sui risultati della somministrazione di scenari alimentari futuri alle giovani generazioni, attraverso focus group e future foresight.

Preparazione: ingresso all'interno della piattaforma TEAMS e ingresso studenti.
Discorso introduttivo: Grazie per partecipare al nostro gruppo di discussione. Il mio nome è Edoardo Desiderio e sono un dottorando in Cooperazione Internazionale e Politiche di sviluppo sostenibile presso il Dipartimento di Scienze e Tecnologie Agro Alimentari, lavoro con il Professor Vittuari e mi occupo di sostenibilità sociale ed economica dei sistemi agro alimentari. Con noi oggi è anche presente la Dr. Laura Garcìa Herrero, post-doc presso il nostro Dipartimento. Vi abbiamo chiesto di partecipare a questa discussione di gruppo oggi che dovrebbe durare un'ora. L'obiettivo di questo gruppo di discussione è indagare la vostra opinione sui sistemi alimentari del futuro, e di come questi potrebbero impattare nella filiera agroalimentare, di cui voi fate parte presumibilmente come consumatori. Perché voi? Perché oltre a fare parte della filiera nelle vesti di chi consuma, siamo interessati a capire qual è la vostra opinion sul futuro dei sistemi alimentari, come ve li immaginate, e quali possono essere le conseguenze per coloro che ne sono coinvolti. Questo focus group serve per condividere tra di voi idee, commenti, stimolando una discussione sui temi che vi verranno presentati. Non ci sono risposte giuste o sbagliate! Vi chiediamo solo di parlare uno alla volta, in modo tale da non perdere neanche un commento!
Vi ringraziamo in anticipo per il tempo che ci state dedicando!

Inizio focus group: presentazione linee guida generali per lo svolgimento dei focus groups.
Presentazione scenario A Società elitaria: 10 minuti
Discussione scenario A: 10 minuti
Domande discussione: Quali sono i cambiamenti positivi che puoi riconoscere in questo scenario? Cosa ti preoccupa di più di questo scenario? Cosa cambierebbe nei tuoi comportamenti e abitudini per questi scenari? Basandosi su quanto abbiamo discusso, e considerando le parti interessate più rilevanti (responsabili politici, imprenditori, agricoltori, produttori di alimenti, rivenditori, cittadini ... e qualsiasi gruppo più specifico) saresti in grado di identificare un vincitore o un perdente?
Presentazione scenario B Società inclusiva e rispettosa dell'ambiente: 10 minuti
Discussione scenario B: 10 minuti
Domande discussione: Quali sono i cambiamenti positivi che puoi riconoscere in questo scenario? Cosa ti preoccupa di più di questo scenario? Cosa cambierebbe nei tuoi comportamenti e abitudini per questi scenari? Basandosi su quanto abbiamo discusso, e considerando le parti interessate più rilevanti (responsabili politici, imprenditori, agricoltori, produttori di alimenti, rivenditori, cittadini ... e qualsiasi gruppo più specifico) saresti in grado di identificare un vincitore o un perdente?
Presentazione scenario C Società chiusa consumista: 10 minuti
Discussione scenario C: 10 minuti
Domande discussione: Quali sono i cambiamenti positivi che puoi riconoscere in questo scenario? Cosa ti preoccupa di più di questo scenario? Cosa cambierebbe nei tuoi comportamenti e abitudini per questi scenari? Basandosi su quanto abbiamo discusso, e considerando le parti interessate più rilevanti (responsabili politici, imprenditori, agricoltori, produttori di alimenti, rivenditori, cittadini ... e qualsiasi gruppo più specifico) saresti in grado di identificare un vincitore o un perdente?
Presentazione scenario D Società 2021: 10 minuti
Discussione scenario D: 10 minuti
Domande discussione: Quali sono i cambiamenti positivi che puoi riconoscere in questo scenario? Cosa ti preoccupa di più di questo scenario? Cosa cambierebbe nei tuoi comportamenti e abitudini per questi scenari? Basandosi su quanto abbiamo discusso, e considerando le parti interessate più rilevanti (responsabili politici, imprenditori, agricoltori, produttori di alimenti, rivenditori, cittadini ... e qualsiasi gruppo più specifico) saresti in grado di identificare un vincitore o un perdente?
Dibattito libero: 15 minuti.

ENGLISH VERSION

Protocol for Focus Groups Focus: testing social sustainability indicators based on the results of the administration of future food scenarios to the younger generations, through focus groups and future foresights.

Introductory speech: Thank you for joining our discussion group. My name is Edoardo Desiderio and I am a PhD student in International Cooperation and Sustainable Development Policies at the Department of Agro-Food Sciences and Technologies, I work with Professor Vittuari and I deal with the social and economic sustainability of agro-food systems. Dr. Laura Garcìa Herrero, post-doc at our Department, is also present with us today. We asked you to participate in this group discussion today which should last an hour. The goal of this discussion group is to investigate your opinion on the food systems of the future, and how these could impact the agri-food chain, of which you are presumably a part of as consumers. Why you? Because in addition to being part of the supply chain as a consumer, we are interested in understanding your opinion on the future of food systems, how you imagine them, and what the consequences may be for those involved.This focus group is used to share ideas, comments among you, stimulating a discussion on the topics that will be presented to you. There are no right or wrong answers! We only ask you to speak one at a time, so that you don't miss a single comment! We thank you in advance for the time you are dedicating to us!

Start of focus groups: presentation of general guidelines for the conduct of focus groups.
Presentation scenario A Elite society: 10 minutes
Scenario A discussion: 10 minutes
Discussion Questions: What are the positive changes you can recognize in this scenario? What worries you the most about this scenario? What would change in your behaviors and habits for these scenarios? Based on what we have discussed, and considering the most relevant stakeholders (policy makers, entrepreneurs, farmers, food producers, retailers, citizens ... and any more specific group) would you be able to identify a winner or a loser?
Presentation of scenario B Inclusive and environmentally friendly society: 10 minutes

Scenario B discussion: 10 minutes
Discussion Questions: What are the positive changes you can recognize in this scenario? What worries you the most about this scenario? What would change in your behaviors and habits for these scenarios? Based on what we have discussed, and considering the most relevant stakeholders (policy makers, entrepreneurs, farmers, food producers, retailers, citizens ... and any more specific group) would you be able to identify a winner or a loser?
Presentation of scenario C Consumerist closed society: 10 minutes
Scenario discussion C: 10 minutes
Discussion Questions: What are the positive changes you can recognize in this scenario? What worries you the most about this scenario? What would change in your behaviors and habits for these scenarios? Based on what we have discussed, and considering the most relevant stakeholders (policy makers, entrepreneurs, farmers, food producers, retailers, citizens ... and any more specific group) would you be able to identify a winner or a loser?
Presentation of scenario D Company 2021: 10 minutes
Scenario discussion D: 10 minutes
Discussion Questions: What are the positive changes you can recognize in this scenario? What worries you the most about this scenario? What would change in your behaviors and habits for these scenarios? Based on what we have discussed, and considering the most relevant stakeholders (policy makers, entrepreneurs, farmers, food producers, retailers, citizens ... and any more specific group) would you be able to identify a winner or a loser?
Free discussion: 15 minutes.

ANNEX B SURVEY:

Validazione indicatori di sostenibilità sociale nei sistemi agroalimentare

Start of Block: Introduzione

Introduzione
Validazione di indicatori di sostenibilità da parte dei cittadini

Ciao, grazie per prendere parte a questo sondaggio! Stiamo testando nuovi indicatori di sostenibilità sociale trovati tramite gruppi di discussione con studenti/esse dell'Università di Bologna e dell'Università di Trento riguardo alla società del futuro, e nello speficifico i sistemi agroalimentari. Vorremmo conoscere la tua opinione a riguardo! Da questo lavoro sono emerse infatti aree di interesse che sembrano richiedere una prioritizzazione da parte delle giovani generazioni, sia per aspetti che riguardano le loro vite, che più esternamente come cittadini. Da queste aree abbiamo ricavato alcuni indicatori che rispecchiano aspetti spesso non integrati all'interno delle politiche di sviluppo, nello specifico nel settore agroalimentare. Esiste infatti un divario tra gli aspetti considerati di intervento prioritario da parte delle giovani generazioni e le misure messe in campo dalle Istituzioni. Una riduzione di questa distanza, con politiche che si avvicinano alle opinioni delle persone potrebbero trovare un riscontro migliore in termini di accettazione e incrementare l'efficacia.

Lo scopo di questo sondaggio è di verificare l'efficacia di questi nuovi indicatori, interamente proposti dalla comunità, ed eventualmente trovarne altri.

End of Block: Introduzione

Start of Block: Informativa privacy

Informativa privacy INFORMATIVA AI SENSI DEGLI ARTT. 13 E 14 DEL REGOLAMENTO EUROPEO 2016/679 (“GDPR”) Ai sensi dell'art. 13 e art. 14 del Regolamento UE 2016/679, si fornisce, qui di seguito, l'Informativa riguardante il trattamento dei dati personali, che sarà effettuato da Edoardo Desiderio in relazione: - alla partecipazione al servizio sopra indicato.
TITOLARE DEL TRATTAMENTO Il Titolare del trattamento dei dati è Edoardo Desiderio, con sede presso il DIpartimento di Scienze e Tecnologie Agro Alimentari dell'Università di Bologna, Viale Fanin 50, Bologna.
RESPONSABILE DELLA PROTEZIONE DEI DATI (RPD/DPO) Il Responsabile della protezione dei dati (RPD/DPO) nominato può essere contattato ai seguenti recapiti: edoardo.desiderio2@unibo.it
OGGETTO DEL TRATTAMENTO, FONTE DEI DATI PERSONALI E CATEGORIE DI DATI TRATTATI Dati personali di persone fisiche oggetto di trattamento sono: genere, età, educazione, dimensioni della città di residenza
Trattamento Dati Particolari Ai sensi dell’Art. 9 del GDPR e dell’art. 2-sexies del Dlgs 196/2003 “È vietato trattare dati personali che rivelino l'origine razziale o etnica, le opinioni politiche, le convinzioni religiose o filosofiche, o l'appartenenza sindacale, nonché trattare dati genetici, dati biometrici intesi a identificare in modo univoco una persona fisica, dati relativi alla salute o alla vita sessuale o all'orientamento sessuale della persona”. Ogni trattamento potrà avvenire solo in presenza di una delle condizioni di cui all’art. 9 del Regolamento Europeo 2016/679 GDPR e dell’art. 2-sexies del Dlgs 196/2003.
FINALITÀ DEL TRATTAMENTO, BASE GIURIDICA DELLO STESSO E PRINCIPI APPLICABILI AL TRATTAMENTO Il trattamento dei dati personali si fonda sulla necessità del trattamento per adempiere obblighi giuridici a cui è soggetto il Titolare del trattamento nonché per lo svolgimento di funzioni a fini di ricerca.
I dati non sono comunicati a soggetti terzi, salvo che la comunicazione sia imposta da obblighi di legge o sia strettamente necessaria ai fini del procedimento o per l’esecuzione di ogni adempimento previsto dalla normativa nazionale e comunitaria.
NATURA DEL CONFERIMENTO: Per l’espletamento delle finalità riportate nel punto precedente il conferimento dei dati è obbligatorio.
MODALITÀ DEL TRATTAMENTO E TEMPI DI CONSERVAZIONE DEI DATI I dati trattati vengono protetti attraverso l’impiego di adeguate misure di sicurezza, organizzative, tecniche fisiche, per tutelare le informazioni dall’alterazione, dalla distruzione, dalla perdita, dal furto o dall’utilizzo improprio o illegittimo. I dati saranno trattati per tutto il tempo necessario alla conclusione della ricerca e successivamente, saranno eliminati. Il trattamento dei dati sarà effettuato in maniera telematica tramite la piattaforma Qualtrics, con logiche correlate alle finalità di cui al precedente paragrafo “FINALITÀ DEL TRATTAMENTO, BASE GIURIDICA DELLO STESSO E PRINCIPI APPLICABILI AL TRATTAMENTO” e, comunque, in modo da garantire la riservatezza dei dati e prevenire la perdita dei dati, usi illeciti o non corretti ed accessi non autorizzati.
DESTINATARI E CATEGORIE DEI DESTINATARI DEI DATI PERSONALI I suoi dati personali non verranno comunicati a nessuno.
PROCESSO DECISIONALE AUTOMATIZZATO E TRASFERIMENTO DI DATI AL DI FUORI DELL’UNIONE EUROPEA I suoi dati personali non saranno soggetti ad alcun processo decisionale automatizzato, compresa la profilazione e non saranno trasferiti al di fuori dell’Unione europea.
DIRITTI DELL’INTERESSATO I soggetti cui si riferiscono i dati personali sopraindicati in qualunque momento posso esercitare: -diritto di chiedere al Titolare del trattamento ex art 15 GDPR 2016/679, di poter accedere ai propri dati personali; -diritto di chiedere al Titolare del trattamento ex art 16 GDPR 2016/679 di poter rettificare i propri dati personali, ove quest’ultimo non contrasti con la normativa vigente sulla conservazione dei

dati stessi; - diritto di chiedere al Titolare del trattamento ex art 17 GDPR 2016/679, di poter cancellare i propri dati personali, ove i dati siano trattati in maniera illecita e sempre che tale cancellazione non contrasti non contrasti con la normativa vigente sulla conservazione dei dati stessi; - diritto di chiedere al Titolare del trattamento ex art 18 DGPR 2016/679 di poter limitare il trattamento dei propri dati personali; -diritto di opporsi al trattamento ex art. 21 GDPR 2016/679; Tutti i soprariportati diritti, in base a quanto previsto all'art. 2/undecies, comma 1, lett. f del Dlgs 196/2003, non potranno essere esercitati qualora dal loro esercizio possa derivare un pregiudizio effettivo e concreto alla riservatezza dell'identità del dipendente che segnala ai sensi della legge 30.11.2017 n. 179 (" whistleblower") l'illecito di cui sia venuto a conoscenza in ragione del proprio ufficio e negli altri casi previsti dalla legge mediante richiesta da inoltrarsi al Titolare del trattamento. Il modulo per l'esercizio dei diritti è disponibile sul sito internet del Garante della privacy DIRITTO DI RECLAMO Gli interessati che ritengono che il trattamento dei dati personali a loro riferiti avvenga in violazione di quanto previsto dal GDPR 2016/679 hanno diritto di proporre reclamo al Garante della Privacy come previsto dall'art. 77 del GDPR o di adire le opportune sedi giudiziarie (art 79 GDPR).

End of Block: Informativa privacy

Start of Block: Info

1 Con quale genere ti identifichi?

Maschile (1)

Femmile (2)

Non-binario (3)

Preferisco non rispondere (4)

2 Quando sei nato?

1946-1964 (Baby Boomer) (5)

1965-1980 (Generazione X) (1)

1981-1996 (Generazione Y, Millennials) (2)

1997-2012 (Generazione Z) (3)

3 Qual è il tuo grado di istruzione?

Licenza elementare (7)

Licenza media (1)

Diploma (2)

Laurea triennale (3)

Laurea magistrale (4)

Laurea a ciclo unico (5)

Dottorato di ricerca (6)

Nessuno (8)

4 Dove si trova la tua abitazione?

Paese (1)

Piccola città 10.001-50.000 abitanti (2)

Media città 50.001-150.000 abitanti (3)

Grande città 150.001-500.000 abitanti (4)

Metropoli > 500.001 abitanti (5)

End of Block: Info

Start of Block: Paese/Country

5 Di dove sei?

▼ Afghanistan (1) ... Zimbabwe (1357)

End of Block: Paese/Countr

Start of Block: Sus

6 Sei a conoscenza degli Obiettivi di Sviluppo Sostenibile proposti e firmati da 193 leaders mondiali all' ONU nel 2015?

Si (1)

No (2)

7 La comunità degli Stati ha approvato l'Agenda 2030 per uno sviluppo sostenibile, i cui elementi essenziali sono i 17 obiettivi di sviluppo sostenibile (OSS/SDGs, Sustainable Development Goals) e i 169 sotto-obiettivi, i quali mirano a porre fine alla povertà, a lottare contro l'ineguaglianza e allo sviluppo sociale ed economico. Inoltre riprendono aspetti di fondamentale importanza per lo sviluppo sostenibile quali l'affrontare i cambiamenti cliatici e costruire società pacifiche entro l'anno 2030. Gli OSS hanno validità universale, vale a dire che tutti i Paesi devono fornire un contributo per raggiungere gli obiettivi in base alle loro capacità

Quali pensi che siano gli obiettivi che necessitano di essere prioritizzati? (Scegline al massimo 6)

Povertà zero: Sradicare la povertà in tutte le sue forme e ovunque nel mondo (1)

Fame zero: Porre fine alla fame, raggiungere la sicurezza alimentare, migliorare l'alimentazione e promuovere l'agricoltura sostenibile (2)

Salute e benessere: Garantire una vita sana e promuovere il benessere di tutti a tutte le età (3)

Istruzione di qualità: Garantire un'istruzione di qualità inclusiva ed equa e promuovere opportunità di apprendimento continuo per tutti (20)

Uguaglianza di genere: Raggiungere l'uguaglianza di genere e l'autodeterminazione di tutte le donne e ragazze (19)

Acqua pulita e igiene: Garantire la disponibilità e la gestione sostenibile di acqua e servizi igienici per tutti (18)

Energia pulita e accessibile: Garantire l'accesso all'energia a prezzo accessibile, affidabile, sostenibile e moderna per tutti (5)

Lavoro dignitoso e crescita economica: Promuovere una crescita economica duratura, inclusiva e sostenibile, la piena occupazione e il lavoro dignitoso per tutti (6)

Industria, innovazione e infrastutture: Costruire un'infrastruttura resiliente, promuovere l'industrializzazione inclusiva e sostenibile e sostenere l'innovazione (7)

Ridurre le disuguaglianze: Ridurre le disuguaglianze all'interno dei e fra i Paesi (8)

Città e comunità sostenibili: Rendere le città e gli insediamenti umani inclusivi, sicuri, resilienti e sostenibili (9)

Consumo e produzione responsabili: Garantire modelli di consumo e produzione sostenibili (10)

Agire per il clima: Adottare misure urgenti per combattere i cambiamenti climatici e le loro conseguenze (11)

La vita sott'acqua: conservare e utilizzare in modo sostenibile gli oceani, i mari e le risorse marine (12)

La vita sulla terra: Proteggere, ripristinare e promuovere l'uso sostenibile degli ecosistemi terrestri, gestire in modo sostenibile le foreste, contrastare la desertificazione, arrestare e invertire il degrado dei suoli e fermare la perdita di biodiversità (13)

Pace, giustizia e istituzioni forti: Promuovere società pacifiche e inclusive orientate allo sviluppo sostenibile, garantire a tutti l'accesso alla giustizia e costruire istituzioni efficaci, responsabili e inclusive a tutti i livelli (14)

Partnership per gli obiettivi: Rafforzare le modalità di attuazione e rilanciare il partenariato globale per lo sviluppo sostenibile (15)

8 Sapevi che a Settemebre 2021, si è svolto a Roma il summit delle Nazioni Unite sul cibo?

Si (1)

No (2)

9 Quanta priorità daresti alle seguenti azioni che sono state promosse dal Food Summit? (trascina le opzioni da 1, la più importante a 5, la meno importante)

_____ Assicurare l'accesso a cibo di qualità per tutti (1)
_____ Muoversi verso modelli di consumo sostenibili (2)
_____ Promuovere sistemi di produzione amici dell'ambiente (3)
_____ Avanzare verso stili di vita equi e sostenbili (4)
_____ Aumentare la resilienza verso le vulnerabilità e gli stress dei sistemi alimentari (5)
End of Block: Sus

Start of Block: Sus2

10 Che ruolo hai nella filiera agro alimentare?

Produttore (1)

Azienda di trasformazione (2)

Grossista (3)

Venditore (Retail, grande e piccola distribuzione) (4)

Consumatore (5)

11 Area tematica: rappresentanza a livello delle istituzioni.

Considerando il tuo ruolo nella filiera agroalimentare, ti sentiresti più rappresenato in un contesto in cui esistono:

Tante e piccole associazioni di settore (1)

Poche e grandi associazioni di settore (2)

12
Area tematica: accesso agli alimenti freschi.

Che cosa è più importante per te avere nel tuo contesto abitativo? (Più risposte possibili)

Accesso a servizi di e-commerce alimentari (1)

Accesso a negozi biologici (2)

Accesso a mercati degli agricoltori (3)

Altro, per favore indica sotto: (4) _____

13 Area tematica: sostenibilità sociale della filiera.

Quali di questi aspetti della filiera pensi possano essere migliorati? (Al massimo due risposte)

Integrare cittadini non europei (4)

Colmare le differenze di stipendi in base al genere (6)

Garantire la possibilità di scioperare (7)

Promuovere incontri tra diversi attori della filiera (8)

Promuovere corsi di educazione alimentare (10)

Incrementare l'uso di certificazioni che garantiscano la sostenibilità dei prodotti (12)

Altro, per favore indica sotto: (9) _____

14 Area tematica: tutela a livello delle istituzioni.

Considerando il tuo ruolo nella filiera agroalimentare, ti sentiresti più tutelato in un contesto in cui esistono:

Tante e piccole associazioni di settore (1)

Poche e grandi associazioni di settore (2)

15 Dai un voto in termini di soddisfazione riguardo ai sistemi alimentari nel tuo contesto abitativo (0, per nulla soddisfatto, 10, molto soddisfatto)

	0 5 10
Accesso ad alimenti freschi ()	
Accesso a mercati degli agricoltori/ vendita diretta ()	
Gestione degli sprechi alimentari ()	
Promozione di una dieta locale ()	

End of Block: Sus2

Validation of social sustainability indicators in agri-food systems

Start of Block: Introduzione

Introduzione Hello and thank you for taking part in this survey! We are testing new indicators of social sustainability found through discussion groups with students of the University of Bologna, Italy, regarding the society of the future, and specifically the agri-food systems. We would like to know your opinion about it! In fact, from this work, areas of interest have emerged that seem to require prioritization by the younger generations, both for aspects that concern their lives, and more externally as citizens. From these areas we have obtained some indicators that reflect aspects that are often not integrated into development policies, specifically in the agri-food sector. In fact, there is a gap between the aspects considered to be a priority intervention by the younger generations and the measures implemented. A reduction of this distance, with policies that are closer to people's opinions, could find a better response in terms of acceptance and increase effectiveness. The purpose of this survey is to verify the effectiveness of these new indicators, entirely proposed by the community, and possibly find others.

End of Block: Introduzione

Start of Block: Informativa privacy

Informativa privacy INFORMATION PURSUANT TO ART. 13 AND 14 OF THE EUROPEAN REGULATION 2016/679 ("GDPR") Pursuant to art. 13 and art. 14 of EU Regulation 2016/679, the information regarding the processing of personal data is provided below, which will be carried out by Edoardo Desiderio in relation to: - participation in the service indicated above. DATA CONTROLLER The data controller is Edoardo Desiderio, based in the Department of Agro-Food Sciences and Technologies of the University of Bologna, Viale Fanin 50, Bologna. DATA PROTECTION MANAGER (RPD / DPO) The appointed Data Protection Officer (RPD / DPO) can be contacted at the following addresses: edoardo.desiderio2@unibo.it OBJECT OF THE PROCESSING, SOURCE OF PERSONAL DATA AND CATEGORIES OF DATA PROCESSED Personal data of natural persons being processed are: gender, age, education, city of residence Treatment of Particular Data Pursuant to Art. 9 of the GDPR and art. 2-sexies of Legislative Decree 196/2003 "It is forbidden to process personal data that reveal racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, as well as to process genetic data, biometric data intended to identify in unambiguously a natural person, data relating to the health or sexual life or sexual orientation of the person ". Each treatment can only take place in the presence of one of the conditions referred to in art. 9 of the European Regulation 2016/679 GDPR and art. 2-sexies of Legislative Decree 196/2003. PURPOSE OF THE PROCESSING, LEGAL BASIS OF THE SAME AND PRINCIPLES APPLICABLE TO THE PROCESSING The processing of personal data is based on the need for processing to fulfill legal obligations to which the Data Controller is subject as well as for the performance of functions for research purposes. The data are not disclosed to third parties, unless the disclosure is required by law or is strictly necessary for the purposes of the procedure or for the execution of any fulfillment required by national and EU legislation. NATURE OF THE PROVISION: For the accomplishment of the purposes indicated in the previous point, the provision of data is mandatory.

PROCESSING METHODS AND DATA STORAGE TIMES The data processed are protected through the use of adequate security measures, organizational, physical techniques, to protect the information from alteration, destruction, loss, theft or improper use. or illegitimate. The data will be processed for as long as necessary for the conclusion of the research and subsequently, they will be deleted. The data processing will be carried out electronically through the Qualtrics platform, with logic related to the purposes referred to in the previous paragraph "PURPOSE OF THE PROCESSING, LEGAL BASIS OF THE SAME AND PRINCIPLES APPLICABLE TO THE TREATMENT" and, in any case, in order to guarantee the confidentiality of data and prevent data loss, illicit or incorrect use and unauthorized access. RECIPIENTS AND CATEGORIES OF RECIPIENTS OF PERSONAL DATA Your personal data will not be disclosed to anyone. AUTOMATED DECISION-MAKING PROCESS AND DATA TRANSFER OUTSIDE THE EUROPEAN UNION Your personal data will not be subject to any automated decision-making process, including profiling and will not be transferred outside the European Union. RIGHTS OF THE INTERESTED PARTY The subjects to whom the aforementioned personal data refer can at any time exercise: - the right to ask the Data Controller pursuant to Article 15 of the GDPR 2016/679 to be able to access their personal data; - the right to ask the Data Controller pursuant to Article 16 of the GDPR 2016/679 to be able to rectify their personal data, if the latter does not conflict with the current legislation on data retention; - right to ask the Data Controller pursuant to Article 17 of the GDPR 2016/679, to be able to delete their personal data, where the data are processed unlawfully and provided that such deletion does not conflict or conflict with the current legislation on data retention ; - right to ask the Data Controller pursuant to Article 18 of the DGPR 2016/679 to be able to limit the processing of their personal data; - right to oppose the processing pursuant to art. 21 GDPR 2016/679; All the aforementioned rights, based on the provisions of art. 2 / undecies, paragraph 1, lett. f of Legislative Decree 196/2003, may not be exercised if their exercise could result in an effective and concrete prejudice to the confidentiality of the identity of the employee who reports pursuant to law no. 179 ("whistleblower") the offense of which he has become aware by reason of his office and in other cases provided for by law by request to be sent to the Data Controller. The form for the exercise of rights is available on the website of the Privacy Guarantor RIGHT OF COMPLAINT Interested parties who believe that the processing of their personal data is in violation of the provisions of the GDPR 2016/679 have the right to lodge a complaint with the Privacy Guarantor as required by art. 77 of the GDPR or to take the appropriate judicial offices (Article 79 GDPR).

End of Block: Informativa privacy

Start of Block: Info

1 What gender do you identify with?

Male (1)

Female (2)

Non binary (3)

I prefer not to answer (4)

2 When were you born?

1946-1964 (Baby Boomer) (5)

1965-1980 (Generation X) (1)

1981-1996 (Generation Y, Millennials) (2)

1997-2012 (Generation Z) (3)

3 What is your degree of education?

Elementary school license (7)

Junior High School license (1)

High school license (2)

Bachelor Degree (3)

Master Degree (4)

Single-cycle Degree (5)

Ph.D. (6)

None (8)

4 Where is your home located?

Village (1)

Small size city 10.001-50.000 inhabitants (2)

Medium size city 50.001-150.000 inhabitants (3)

Big size city 150.001-500.000 inhabitants (4)

Metropolis >500.001 inhabitants (5)

End of Block: Info

Start of Block: Paese/Country

5 Where are you from?

▼ Afghanistan (1) ... Zimbabwe (1357)

End of Block: Paese/Country

Start of Block: Sus

6 Are you aware of the Sustainable Development Goals proposed and signed by 193 world leaders at the Uinted Nations in 2015?

Yes (1)

No (2)

7 Worldwide governemnts have approved the 2030 Agenda for Sustainable Development, the essential elements of which are the 17 Sustainable Development Goals (SDGs / SDGs) and 169 sub-goals, which aim to end poverty, to fight against inequality and social and economic development.

They also take up aspects of fundamental importance for sustainable development such as tackling climate change and building peaceful societies by the year 2030. The SDGs have universal validity, meaning that all countries must make a contribution to achieve the objectives based on to their abilities.

What do you think are the goals that need to be prioritized? (Choose a maximum of 6)

Zero Poverty: To eradicate poverty in all its forms and everywhere in the world (1)

Zero hunger: End hunger, achieve food security, improve nutrition and promote sustainable agriculture (2)

Health and Wellness: Ensuring a healthy life and promoting the well-being of all at all ages (3)

Quality education: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (20)

Gender equality: Achieving gender equality and self-determination for all women and girls (19)

Clean water and sanitation: Ensure the availability and sustainable management of water and sanitation for all (18)

Clean and accessible energy: Ensuring access to energy at an affordable, reliable, sustainable and modern price for all (5)

Decent work and economic growth: Promote sustained, inclusive and sustainable economic growth, full employment and decent work for all (6)

Industry, innovation and infrastructure: Building a resilient infrastructure, promoting inclusive and sustainable industrialization and supporting innovation (7)

Reduce inequalities: Reduce inequalities within and between countries (8)

Sustainable Cities and Communities: Making cities and human settlements inclusive, safe, resilient and sustainable (9)

Responsible Consumption and Production: Ensuring sustainable consumption and production patterns (10)

Acting for the climate: Taking urgent measures to combat climate change and its consequences (11)

Life Underwater: Conserve and sustainably use the oceans, seas and marine resources (12)

Life on earth: Protect, restore and promote the sustainable use of terrestrial ecosystems, manage forests in a sustainable way, combat desertification, stop and reverse soil degradation and stop the loss of biodiversity (13)

Peace, justice and strong institutions: Promote peaceful and inclusive societies oriented towards sustainable development, guarantee access to justice for all and build effective, responsible and inclusive institutions at all levels (14)

Partnership for the Goals: Strengthen the means of implementation and revive the global partnership for sustainable development (15)

8 Did you know that the United Nations food summit took place in Rome in September 2021?

Yes (1)

No (2)

9 How much priority would you give to the following actions, that have promoted by the Food Summit? (Draw the options from most important, 1st position, to least important, 5th position)

_____ Ensuring access to quality food for all (1)

_____ Moving towards sustainable consumption models (2)

_____ Promote environmentally friendly production systems (3)

_____ Advancing towards fair and sustainable lifestyles (4)

_____ Increase resilience to the vulnerabilities and stresses of food systems (5)

End of Block: Sus

Start of Block: Sus2

10 What role do you have in the food supply chain?

Producer (1)

Processing company (2)

Wholesaler (3)

Retailer (4)

Consumer (5)

11 Thematic area: representation within institutions.

Considering your role in the food chain, you would feel more represented in a context where there are:

Many and small industry associations (1)

Few and large industry associations (2)

12 Thematic area: access to fresh food.

What is most important for you to have in your living environment? (Multiple answers possible)

Access to food e-commerce services (1)

Access to organic shops (2)

Access to farmers' markets (3)

Other, please indicate below: (4) _____

13 Thematic area: social sustainability of the supply chain.
Which of these aspects of the supply chain do you think could be improved? (Two answers maximum)

Integrate non-European citizens (4)

Guarantee the possibility of striking (6)

Bridging the gender pay gap (7)

Promote dialogue between different players in the supply chain (8)

Promote food education courses (10)

Increase the use of certifications that guarantee the sustainability of products (12)

Other, please indicate below: (9) _____

14 Thematic area: protection at the level of the institutions. Considering your role in the food chain, you would feel more protected in a context where there are:

Many and small industry associations (1)

Few and large industry associations (2

15 Rate your satisfaction with the food systems in your home setting (0, not satisfied at all, 10, very satisfied)

	0 5 10
Access to fresh food ()	
Access to farmers' markets / direct sales ()	
Food waste management ()	
Promotion of a local diet ()	

End of Block: Sus2