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Via Umberto I, 78/80

65010 Cappelle sul Tavo (PE)

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The Effects of Unfair Trading Practices in the Agri-Food Chain from an Environmental Perspective: A Review

Ilenia Colamatteo*

Department of Economics and Law
University of Cassino and Southern Lazio
E-mail: ilenia.colamatteo@unicas.it

Ilenia Bravo

Department of Economics and Law
University of Cassino and Southern Lazio
E-mail: ilenia.bravo@unicas.it

Lucio Cappelli

Department of Economics and Law
University of Cassino and Southern Lazio
E-mail: cappelli@unicas.it

Enrica Iannucci

Department of Economics and Law
University of Cassino and Southern Lazio
E-mail: enrica.iannucci@unicas.it

Patrizia Papetti

Department of: Economics and Law
University of: Cassino and Southern Lazio
E-mail: patrizia.papetti@unicas.it

** Corresponding author*

Abstract

Nowadays, an agri-food system based on fair practices is fundamental to ensure ethical and sustainable production. These practices can have repercussions both on the quality of the product and on the environment, in addition to the economic and social implications. This research study is based on a scoping literature review, following the PRISMA methodology, to identify the effects that unfair trading practices could have on agri-food production in terms of environmental effects. A total of 47 articles were included in the review. The results highlight that commercial practices play a fundamental role in determining market competitiveness, and the environmental impacts can be seen through the phenomenon of food waste and loss. Due to the lack of research on the relationship between the unfair trading practices and their environmental impacts, further study is required to guarantee fairness throughout the supply chain and a sustainable production process.

Keywords – Unfair Trading Practices; Environmental Impact; Agri-food; Climate Change; Food Loss.

Paper type – Literature Review

Sommario

Gli effetti delle pratiche commerciali sleali nella filiera agroalimentare da una prospettiva ambientale: una revisione. – Oggigiorno, un sistema agroalimentare basato su pratiche eque è fondamentale per garantire una produzione etica e sostenibile. Tali pratiche possono avere ripercussioni sia sulla qualità del prodotto che sull'ambiente, oltre alle implicazioni economiche e sociali. Questo studio si basa su una revisione della letteratura di *scoping*, seguendo la metodologia PRISMA, per identificare gli effetti che le pratiche commerciali sleali potrebbero avere sulla produzione agroalimentare in termini di effetti ambientali. Nella revisione sono stati inclusi 47 articoli in totale. I risultati evidenziano che le pratiche commerciali svolgono un ruolo fondamentale nel determinare la competitività del mercato e gli impatti ambientali possono essere visti attraverso il fenomeno dello spreco e della perdita di cibo. A causa della scarsità di ricerche sulla relazione tra le pratiche commerciali sleali e i loro impatti ambientali, sono necessari ulteriori studi per garantire l'equità lungo tutta la filiera e un processo di produzione sostenibile.

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1 Introduction

Agri-food chains based on equity and the adequate distribution of value are considered an increasingly important issue according to the sustainable development goals, with particular reference to SDG12 on consumption and production patterns (Moreira-Dantas, Martínez-Zarzoso, & Torres-Munguía, 2023).

These supply chains are a multidimensional multi-actor system, involving different sectors and stakeholders, such as farmers, intermediaries, retailers, and consumers (Khan, Behrendt, Papadas, & Arnold, 2024).

Therefore, food systems are complex networks of processes that include all the inputs and outputs associated with production, processing, distribution, and purchasing. In this sequence, issues related to unfair trading practices may occur, which can have serious repercussions depending on the actors involved. Market unfairness can be of various types, such as aggressive and fraudulent behaviours towards consumers, those between direct competitors, and those among different actors in the same supply chain (Del Prete, Golossenko, Gorton, Tocco, & Samoggia, 2024).

Unfair behaviour towards consumers is one that induces them to purchase error, limiting their decision-making ability through false and insufficient product information. These can include propaganda campaigns, fake consumer product reviews, and false advertising.

Among competitors, unfair behaviours can consist of excessive price reduction (dumping), counterfeiting the products of competitors, and violating intellectual property rights.

Regarding those between different actors of the supply chain, they can include delayed order payments, last-minute cancellations, and unilateral supplier contract modifications (Sujianto et al., 2024). This paper focuses on this kind of unfair behaviour, often referred to as “B2B” unfairness.

According to the EU 2019/633 regulation, Unfair Trading Practices (UTPs) are broadly defined as practices that grossly deviate from good commercial conduct and fair dealing, as well as being often unilaterally imposed by one trading partner onto another. This asymmetry causes contractual imbalances that benefit the more powerful partner, who is capable of negotiating more favourable prices or better terms and conditions (Kononets, Treiblmaier, & Rajčániová, 2022). These practices are detrimental to the weaker actors in the supply chain, particularly small farmers, causing both socio-economic and environmental repercussions, as well as negative effects on product quality.

Disparities in economic size and power are prominent in agri-food supply chains, for instance, between small-scale producers and farmers on one hand and large multi-national food processors and retailers on the other. Due to agriculture occupying one-half of the world’s habitable land and agri-food systems producing one-third of all greenhouse gas emissions, these supply chains are being questioned concerning the transition towards more responsible production and consumption.

Recent research shows that individual farmers and small and medium enterprises lose, on average, 2.27% of their total annual turnover due to the harmful effects of unfair trading practices caused by power asymmetries (Kononets, Treiblmaier, & Rajčániová, 2022). UTPs can cause enormous losses, which can take the form of lost profits, wasted expenditure, spoiled or unsold goods and wasted time. Therefore, practical solutions are needed to address this problem in the food industry (Merlino, Borra, Bargetto, Blanc, & Massaglia, 2020).

From an economic point of view, a possible solution could be that of guaranteeing fair compensation to farmers and a fair price to consumers. This would be beneficial for contributing to economic equity, providing a basis for more sustainable agricultural practices and responsible management of resources, as well as influencing the availability of accessible, nutritious, and safe food. More recently, both academic and practitioner interests have shifted to holistic, “triple bottom line” (profit, people, planet) approaches in support of supply chains that are fairer economically, socially, and environmentally (Del Prete, Golossenko, Gorton, Tocco, & Samoggia, 2024).

With this study, the information expected to be obtained will serve as a preliminary basis for other researchers to conduct further investigations and for policymakers to reinforce legislation regarding UTPs.

2 Methodology

Despite UTPs becoming an interesting political topic and the attention placed on their ethical impact, from the study conducted, there is relatively little research on the consequences from an environmental perspective. In light of these premises, a scoping review was conducted to map out the state-of-the-art of the peer-reviewed literature and to identify any existing gaps in the knowledge available. Therefore, the following research question was composed: what are the potential environmental impacts of unfair trading practices in the agri-food chain?

2.1 Methodological approach

Based on the current literature, a scoping review was undertaken to analyse the main issues related to the agrifood chain and unfair trading practices. Colquhoun et al. (2014) defines scoping reviews as “a form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in research related to a defined area or field by systematically

searching, selecting, and synthesising existing knowledge”. This approach was selected because the findings of the study can serve as a foundation for a future systematic review.

The review was conducted in accordance with the *Preferred Reporting Items for Systematic reviews and Meta-Analysis Protocols extension for Scoping Reviews* (PRISMA-ScR) (Page et al., 2021). This literature review method involves a series of steps that rigorously apply the selection criteria to systematically analyse, reinterpret, expand, and deepen the existing literature while facilitating knowledge dissemination.

The scientific articles were collected between November and December 2024. Scopus, Google Scholar, and Web of Science were the main bibliographic databases used to carry out the search. A draft of the search strategies was discussed by the research and further refined. A specific string of keywords was defined, and papers were selected from the results obtained from the search within the titles, abstracts and author keywords: (“market power” OR “unfair trade” OR “market share”) AND (“environmental sustainability” OR “climate change” OR “product quality”). These keywords were chosen to identify papers focused on market competitiveness, unfair trading, and environmental effects.

2.2 Review protocol

From Table 1, for reviewing papers needed to be centred around the environmental impacts of unfair practices on the agri-food supply chain. According to the review protocol, papers were considered if they were: published between in the period of 2015-2024, written in English, involved primary or secondary studies, and described agri-food supply chain and fairness. Qualitative, quantitative, as well as mixed-method studies, were included in order to consider the various issues that may induce the occurrence of unfair practices. This study has included conference proceedings in order to extract all possible insights into this emerging research field. All other elements of grey literature were not considered. Furthermore, the references of the selected papers were examined to enhance the selection process. The reference citation management tool utilized for the final results was Zotero.

To ensure consistency in the review process, a sample of 10 random articles were screened by two reviewers and subsequently discussed to create a homogenous reviewing criterion.

The papers which resulted from the initial search underwent a second selection process which examined the full articles. An Excel spreadsheet was utilised to record the data of the selected studies to favour a more efficient interpretation and analysis during the review process.

Table 1 – Review protocol

Item	Description
Keywords	Market power; Unfair trade; Market share; Environmental sustainability; Climate change; Product quality.
Inclusion	Primary and secondary sources; Published articles, reviews, books, book chapters and conference proceedings; Papers with qualitative, quantitative methods and conceptual studies on unfair practices only in the agri-food chain, indicators, impacts of these practices on the environment.
Exclusion	Papers not written in English; All other forms of grey literature; Papers that do not focus on the agri-food supply chain; Studies centered only on legislative, economic and social aspects.
Publishers	Springer; Taylor & Francis; Elsevier; MDPI; Wiley; IEEE; Emerald; ACM.
Time Period	January 2015 to December 2024.

Source: Authors'elaboration

3 Results

As shown in the PRISMA flow diagram (see Figure 1), the search strategy initially produced 799 papers which amounted to 485 papers after duplicate removal. As a first step the remaining articles were screened by title and abstract in order to include only studies that met all the review protocol criteria (see Table 1) for the full-text analysis. This final extraction phase produced a total of 47 records.

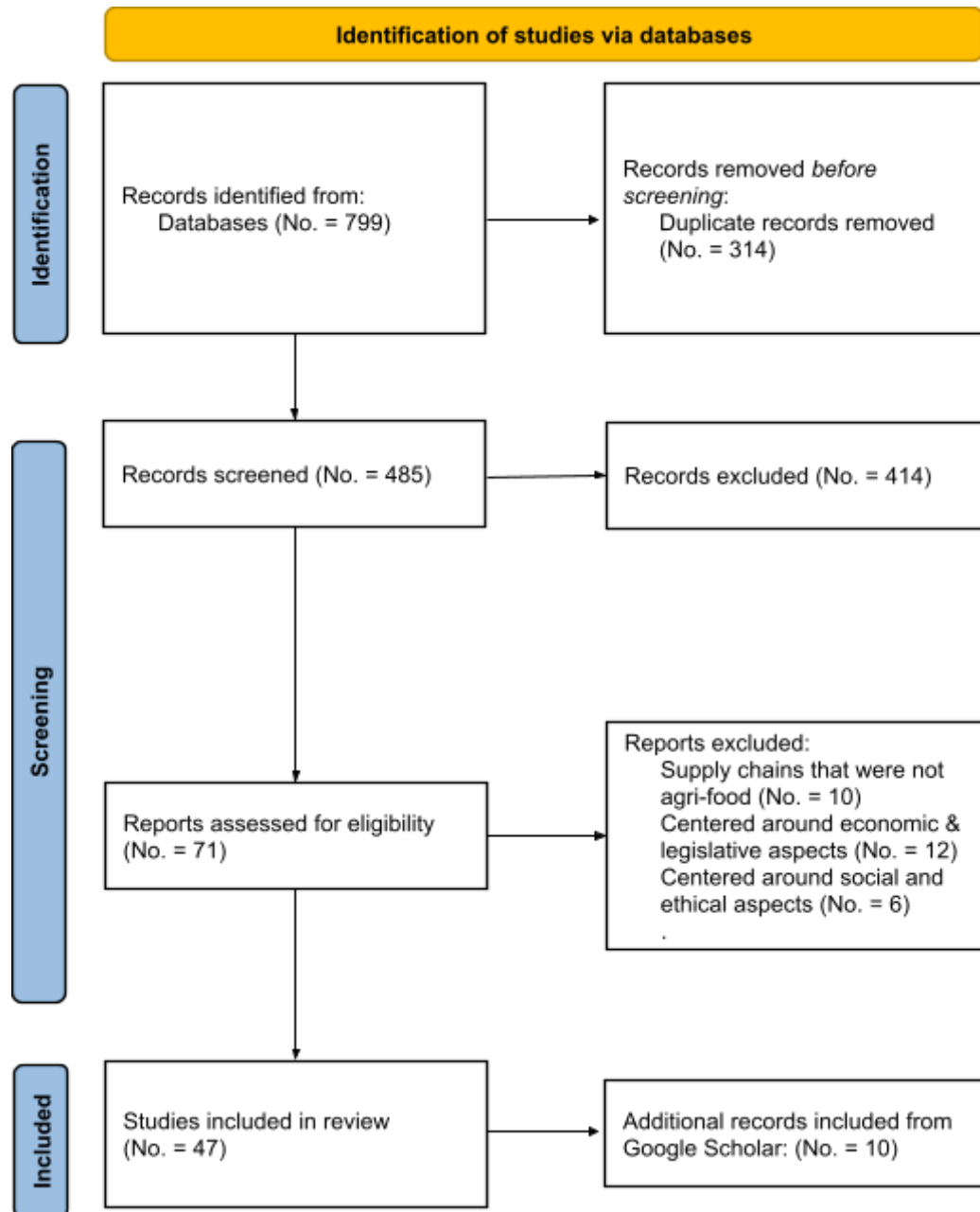
The main recurring issues on which each paper focuses have been identified (see Appendix, Table 2) and include product quality (20), environmental impacts (15), labelling and branding (7), food loss and waste (6), and competitiveness (6).

Figure 2 shows that there has been an increase in the number of publications in the last five years, with 2024 being the year with the most publications. This incrementation can be explained by the introduction of the EU directive 2019/633 on unfair trading practices in the agricultural and food supply chain. More than 70% of all publications dealing with the environmental impacts of UTPs appeared within the last five years, as academic interest increased greatly.

The software VosViewer was utilised to conduct a network analysis uncovering the co-occurrence relationships based on the keyword frequency. As shown in Figure 3, the connections between the various nodes, which represent the keywords, can be visualised. The dimension of the nodes shows how often a keyword has been used in the records reviewed. It can be noted that the largest keyword community is that of “competition”, which has a stronger connection with the nodes “commerce”, “climate change” and “sustainability”. It can be deduced that this word is strongly correlated with the concepts of market power and environmental impact. “Climate change” is the other most frequently mentioned keyword community, in association with “co-creation”, and “cosmetic appearance”. It seems

that this keyword has a significant connection with the concepts of value creation, product appearance, and commercialization.

Figure 1 – PRISMA flow diagram



Source: Authors'elaboration

4 Discussion

From the results, it has been difficult to find a direct correspondence between UTP and environmental issues. However, there is evidence of a connection between market competition and the relative impacts on the environment.

4.1 Market competitiveness

Every enterprise aims to satisfy the needs of their consumers in order to create a strong customer loyalty in a more efficient way than that of their competitors. UTPs can intervene in this scenario causing imbalances in the market. Furthermore, if UTPs yield a competitive advantage for one actor, others might be forced to follow suit to avoid losing their competitive edge. Among the consequences there is the lack of market transparency, asymmetry along the entire food supply chain, private retailer marketing standards and inequalities in bargaining power (Fałkowski, Ménard, Sexton, Swinnen, & Vandeveld, 2017).

From the study, one of the indirect effects of the regulation (EU 2019/633) is the loss of investments in advanced technology which would favour the transition towards a green production system (Midingoyi, Kassie, Muriithi, Diiro, & Ekesi, 2019; Ogutu, Gödecke, & Qaim, 2020). From an economic perspective in which producers are oriented towards Agriculture 4.0, investments in smart technologies cannot be contained, if the producer is to remain competitive on the market. Generally, to increase profit margins, the simplest and fastest solution for producers is to reduce the cost of production, for example through the use of unsustainable farming methods. However, this would lead to a reduction in the quality of their products. To avoid this, a more sustainable long-term option would be the introduction of new technologies that allow farms to increase production and maximize yields while also incrementing competitive market pressures (Faleri, 2022; Martin-Ortega et al., 2024).

Another possible solution could be to implement a product differentiation strategy which takes into account sustainability attributes that reflect environmental and social pressures (Sok, Borges, Schmidt, & Ajzen, 2021). In fact, in recent years, agricultural producers have introduced innovative technological production and processing systems in order to achieve high standards of product sustainability. Additionally, investments are made to favour positive communication strategies through the divulgation of claims, such as the use of recycled materials in packaging, reducing pesticide use, etc. (Edwards, Sonnino, & Cifuentes, 2024; Merlino, Borra, Bargetto, Blanc, & Massaglia, 2020). Moreover, from the articles reviewed, it emerges that to differentiate the product offering, producers must generate food products that conform to high-quality standards.

Certification plays a fundamental role in guaranteeing compliance with high-quality production standards by following specific production protocols. For example, products with a certified origin and guarantee of traceability, i.e. PDO, PGI, TSG, are deemed of high quality.

Other certifications include those issued by the International Organization for Standardization (i.e. ISO 14001, ISO 14025), which address the problem of sustainable production, including economic, social and environmental needs (Gil, Ruiz, Escrivá, & Manyes, 2017). One of the most important private voluntary certifications for primary production is the GlobalGAP system, which sets standards and procedures for good agricultural practices, food safety, environmental protection, food traceability, and human health (Merlino, Borra, Bargetto, Blanc, & Massaglia, 2020).

On the market, certified products compete with those without certification, where quality controls and origin are not always clearly defined. Achieving certification standards can offer different benefits for producers, such as the possibility of opening up to several markets and improving business performance. Additionally, it helps to manage and mitigate risks related to major environmental concerns, such as emission control and biodiversity loss (Corticeiro, Brás, Tomé, Lillebø, & Vieira, 2024; Verbruggen & Laes, 2021). From a consumer point of view, certification can greatly impact their trust in the brand and their buying decisions (Ab Talib, 2017). UTPs can indirectly influence certification processes, as they are associated with creating unequal value distribution, which can potentially cause economic loss for the producer who is forced to leave the certification procedure.

Consequently, it can be deduced that market competitiveness is linked to the adoption of ethical business practices and responsible consumer purchasing behaviour.

4.2 Environmental impacts

4.2.1 Determination of indirect impacts

From the literature analysis, no direct environmental consequences from UTPs emerge. However, two indirect impacts were identified: the first is the generation of food loss and waste, and the second is the operation of unsustainable production systems. These impacts are caused by imbalances in commercial relationships between suppliers and traders regarding the management of orders and returns and the lack of investment in sustainable technologies. In terms of orders, issues related to discontinuity in delivery requests are most frequent, as well as over-ordering, last-minute orders and unexpected cancellations. In terms of fresh products, there is a loss of the value of unsold goods, which generates food waste and loss. Regarding non-perishable goods, there are extra storage costs to cover. Returns, on the other hand, can be classified as UTPs in case of the return of conforming unsold products. These

practices are characterised by a one-sided, unpredicted nature and lack of transparency. Current systems lack the implementation of technologies that make the production process more sustainable from an economic, social and environmental perspective. Thus, without adequate investment allocation and management, enterprises cannot improve their performance and progress.

According to Porter, Reay, Bomberg, and Higgins (2018), the greatest drivers of food loss and waste are “aesthetic imperfection” and “over planting” of produce. In supply contracts established between producers and retailers, conditions on quantities and delivery times are imposed by the buyer, along with strict product quality standards in terms of aesthetics and features. These private marketing standards are set under the retailers’ hypothesis that customers would not be willing to buy suboptimal products (Amicarelli and Bux, 2021; Pietrangeli, Herzberg, Cicatiello, & Schneider, 2023). This kind of behaviour can be classified as a UTP only when it is used strategically to reject conforming products.

Farmers are forced to meet their contractual obligations and deliver a specified tonnage of produce that meets particular standards. In fact, in many cases, if a portion of the yield does not meet the established aesthetic criteria, it is difficult to sell and possibly even to harvest. These aesthetics-centred quality criteria, derived from physical characteristics of attractiveness alone, are imposed on many producers by downstream actors (such as regulators, retailers, and consumers).

According to the Food Waste Index Report (UNEP, 2024), one-fifth of the food produced for human consumption is lost or wasted, the equivalent of one billion meals a day, causing significant environmental, social and economic consequences. When food is lost, the resources, such as water, land, energy, and the materials necessary for production, are lost too.

Food loss and waste generate up to 10% of global greenhouse gas (GHG) emissions, primarily nitrous oxide (N₂O) and nitrates from nitrogenous fertilizers, methane (CH₄) from fermentation and carbon dioxide (CO₂), resulting in 22,500 kt CO₂-eq emissions annually in the European Economic Area (Kazancoglu, Ekinci, Mangla, Sezer, & Kayikci, 2021). Porter, Reay, Bomberg, and Higgins (2018) estimated avoidable food loss and waste from on-farm aesthetic grade-outs of up to 51,500 kt yr⁻¹ in the European Economic Area. Furthermore, the use of fresh water for irrigation also contributes to environmental impacts; in fact, agriculture is said to be the largest water exploiter in the world (Berry, 2015).

However, knowledge of losses and waste is not equally recorded along the food chain. In fact, for some phases, there is a lack of primary data necessary to estimate the problem. Certainly, the phases from the post-harvest to the logistics process are the most sensitive, where times and temperatures influence the storage, processing and transportation of food. Packaging is one of the critical phases of the supply chain because it protects the product, especially in the case of perishable foods, and it displays a series of information about the product. In fact, according to some authors, the quality of the

packaging impacts the shelf-life, and the use of improper raw materials can cause damage to the product, deterioration, or the risk of contamination which all lead to food loss (Riesenegger & Hübner, 2022). For example, in Europe 5% of fruit and vegetables are lost in postharvest handling and storage, 2% during processing and packaging, and an additional 10% of fresh and 2% of processed fruit and vegetables during distribution (Surucu-Balci & Tuna, 2021).

Recently, producers have begun promoting their sustainably produced products using green communication strategies in labelling. According to Hartling (2019), eco-labelling can help to regulate and promote climate change mitigation and carbon footprint reduction. However, unfair behaviour may occur, generating negative environmental impacts. In some cases, producer's adopt strategies to convey environmentally friendly production methods using claims, ambiguous wording, green-coloured packaging and nature-evoking images without reflecting an actual environmental commitment, thus deceiving consumers. This phenomenon is known as *Greenwashing* and constitutes a threat to the development of an environmentally and economically sustainable market (Boncinelli, Gerini, Piracci, Bellia, & Casini, 2023).

4.2.2 Potential resolute scenarios

Among the possible solutions identified, a short supply chain planning period, with fewer production phases and intermediaries, greater transparency in communication strategies, as well as rapid access to local markets, could help to reduce waste, generating fewer impacts and promote adaptation to climate change (Amahnui, Vanegas, Verchot, & Castro-Nunez, 2025; Zeilinger, Kantelhardt, & Niedermayr, 2025).

Another strategy can be to intervene in the supplier-retailer interface in terms of take-back agreements. In this case, retailers can adopt so-called "buy-and-burn strategies" where products are over-purchased and the unsold goods are sent back through reverse returns, while the supplier is forced to accept the returns and cover the extra transport and processing costs. The management of these returns exerts strong pressures in environmental terms and are among the main factors responsible for generating loss and waste of natural resources in the agri-food supply chain (Ghosh & Eriksson, 2019). The environmental impacts of these dynamics have not yet been considered in the current literature. For future research, it would be interesting to implement monitoring systems and raise awareness on the sustainability of these practices.

Some suggestions can be drawn from this study. For producers, it is certainly necessary to focus on targeted agricultural sustainable management. The reuse of residual waste biomass from the returned goods, appropriately treated, could be used in a recovery process for the production of biogas or compost, which would generate a lower impact on the environment by producing environmental credits.

Furthermore, it is necessary to encourage political decision-makers to create proposals that incentivise retailers to improve management of products that are close to the use by date, to opt for products that are locally produced and in season, and to redistribute excess goods by offering discounts or through donations.

The lack of research present on the environmental impact of UTPs in the agri-food sector is more than likely due to the lack of data in agricultural production in terms of impact analysis, because of the fact that this sector is subject to an intrinsic variability that is not present in industrial manufacturing. Scientific research offers various tools capable of assessing the environmental impact of human activities and proposing possible mitigation actions to fill the gaps in the literature. Among these, the methodology that has become a standard in recent decades is the Life Cycle Assessment (LCA), which allows the analysis of an entire production cycle by identifying possible critical points and proposing possible improvements. Another possible approach is that of the analysis of specific case studies with semi-structured interviews in order to obtain timely and comprehensive data, to estimate the economic and environmental effects of the supply chain, and to construct a decision-making framework on the sustainable orientation of commercial practices.

5 Conclusion and outlook

A food supply chain comprises all activities which move food items from a primary producer to final consumers. The farmers represent the first stage of the agri-food chain, where there is a risk of unfair trading practices taking place. These could translate into low bargaining power and anti-competitive practices. Whereas, the consumers represent the final stage of the chain, which, through the adoption of fairness-oriented food choices and perceived value of fair food, can contribute to the sustainable development of the agri-food chain.

From the review, it is clear that these UTPs can generate impacts on an environmental level, such as producing emissions generated from unsold food products, thus contributing to climate change.

Further research is necessary, as there are limited studies available regarding the indicators that measure the level of environmental impact generated from UTPs.

A future prospect could be that of improving the flow of information throughout the supply chain in order to enable a more efficient demand and order forecasting. Additional studies could be conducted on the implementation of blockchain technology in the recording of data throughout the supply chain to increase transparency and quantify both upstream and downstream losses and waste. Therefore, further exploration of problems related to fairness in food value chains and the development of possible

solutions to increase product quality and fairness perceptions among consumers will be conducted in the future.

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Appendix

Table 1 – References of articles reviewed

No.	Authors	Year	Title	Journal/ Book Source	Theme	Keywords
1	Porter, Reay, Bomberg, & Higgins	2018	Avoidable food losses and associated production-phase greenhouse gas emissions arising from application of cosmetic standards to fresh fruit and vegetables in Europe and the UK	<i>Journal of Cleaner Production</i>	Food loss and waste	Climate change mitigation, Food supply chain, Cosmetic standards, Fresh fruit and vegetables, Embedded emissions, Food loss and waste
2	Basso, Neves, & Grossi-de-Sa	2024	Agriculture evolution, sustainability and trends, focusing on Brazilian agribusiness: a review	<i>Frontiers in Sustainable Food Systems</i>	Sustainable innovation	Biotechnology, Climate changes, Disruptive technologies, Molecular sciences, Scientific research, Sustainable agriculture
3	Ab Talib	2017	Motivations and benefits of <i>halal</i> food safety certification	<i>Journal of Islamic Marketing</i>	Certification	<i>Halal</i> , <i>Halal</i> certification, <i>Halal</i> food, Food safety certification
4	Bataineh, Sánchez-Sellero, & Ayad	2024	Green is the new black: How research and development and green innovation provide businesses a competitive edge	<i>Business Strategy and the Environment</i>	Competitiveness / Product quality	Bias-correction estimation in panel data, Competitive advantage, Fuzzy difference-indifference, Green innovation, Propensity score matching, R&D
5	Berry	2015	Breeding the dairy cow of the future: What do we need?	<i>Animal Production Science</i>	Environmental impacts	Genetics, Heritability, Genomic, Breeding objective
6	Boncinelli, Gerini, Piracci, Bellia, & Casini	2023	Effect of executional greenwashing on market share of food products: An empirical study on green-coloured packaging	<i>Journal of Cleaner Production</i>	Labelling	Marketing strategy, Choice experiment, Segmentation, Labelling, Environmental sustainability
7	Bruce & Faunce	2015	Sustainable fuel, food, fertilizer and ecosystems through a global artificial photosynthetic system: Overcoming anticompetitive barriers	<i>Interface Focus</i>	Environmental impact	Artificial photosynthesis, Carbon dioxide, Fixation, Food and fuel security, Environmental sustainability, Competition law

8	Corticeiro, Brás, Tomé, Lillebø, & Vieira	2024	Forest certification and economic insights: A European perspective	<i>Frontiers in Forests and Global Change</i>	Certification	Forest management, Sustainability, FSC, PEFC, Policy, Market share
9	Edenbrandt & Lagerkvist	2024	Can gene-editing accelerate the protein shift? Consumer acceptance of an upcycled meat-substitute	<i>Food Policy</i>	Food loss and waste / Environmental impact	Upcycled food, Gene-edited food, Market prediction, Food loss, Food waste, Consumer behaviour
10	Faunce & Bruce	2016	Governing the global food system towards the sustainocene with artificial photosynthesis	<i>International Food Law and Policy</i>	Environmental impact	-
11	Federici, Gentilucci, Bernini, Vittadini, & Pellegrini	2021	Ready to eat shelf-stable brown rice in pouches: Effect of moisture content on product's quality and stability	<i>European Food Research and Technology</i>	Product quality / Packaging	Brown rice, Ready to eat, Shelf life, Rice texture
12	Gazdecki, Leszczyński, & Zieliński	2021	Food sector as an interactive business world: A framework for research on innovations	<i>Energies</i>	Sustainable innovation	Business networks, Business relationships, Co-creation, Open innovations, Food markets, Sustainable food supply
13	Gerber, Dix, & Cash	2024	Marketing plant-based versus animal-sourced foods in online grocery stores: A comparative content analysis of sustainability and other product claims in the United States	<i>Business Strategy and the Environment</i>	Product quality / Labelling	E-commerce, Food labels, Health, Marketing, Plant-based, Sustainability
14	Gilbert, Koska, & Oladi	2022	Foreign market entry, upstream market power, and endogenous mode of downstream competition	<i>Review of International Economics</i>	Product quality/ Competitiveness	Cournot-Bertrand-Nash equilibrium, Horizontal product differentiation, International trade, Upstream market power, Vertical product differentiation
15	Ginting & Malik	2020	Crude palm oil product quality control using seven tools (case study: XYZ Company)	<i>IOP Conference Series: Materials Science and Engineering</i>	Product quality	-
16	Glare & O'Callaghan	2019	Microbial biopesticides for control of invertebrates: Progress from New Zealand	<i>Journal of Invertebrate Pathogeny</i>	Environmental impact	Microbial control, Bacteria, Fungi, Nematodes, Regulation, New Zealand, Biological control

17	Hartling	2019	Design a successful program for voluntary carbon footprint reduction	<i>International Journal of Supply Chain Management</i>	Labelling / Environmental impact	Eco-label, Sustainability, Carbon footprint, Voluntary program, Corporate social responsibility
18	Hong	2016	Effects of exchange rate and world prices on export price of Vietnamese coffee	<i>International Journal of Economics and Financial Issues</i>	Product price / Product quality / Branding	Price, Coffee, Export, Vietnam, Fluctuation
19	Hossain M. A., Hossain M. S., & Akter	2023	Challenges faced by plant growth-promoting bacteria in field-level applications and suggestions to overcome the barriers	<i>Physiological and Molecular Plant Pathology</i>	Fertilization	Bacteria, Biofertilizer, Bioinoculant, Formulation, Crop production
20	Iacovides & Vrettos	2022	Falling through the cracks no more? Article 102 TFEU and sustainability: The relation between dominance, environmental degradation, and social injustice	<i>Journal of Antitrust Enforcement</i>	Competitiveness / Environmental impact	Competition law, Antitrust, EU law, Monopolisation, Dominance, Market Power, Resilience, Public policy, Environment, Climate change, Social justice, Undertakings, Consolidation, Human rights
21	Küçükgöz & Trzaskowska	2022	Nondairy probiotic products: Functional foods that require more attention	<i>Nutrients</i>	Product quality / Environmental impact	Fermentation, Functional food, Nondairy food, Plant foods, Probiotic, In vitro digestion
22	Kulikova & Kondratenko	2024	Eco-branding and consumer behavior: Innovative marketing strategies in ecology and environmental sciences	<i>E3S Web of Conferences</i>	Branding/Environmental impact	-
23	Liu & Zhang	2020	Green product design considering consumer's income and environmental awareness	<i>IOP Conference Series: Earth and Environmental Science</i>	Product quality / Environmental impact	-
24	Liu, Xu M., Xu J., Zhang, Li, Yuan, et al.	2024	Humic acid urea enhanced productivity and reduced active nitrogen loss in summer maize-winter wheat cropping system: A field lysimeter experiment	<i>Field Crops Research</i>	Fertilization	Humic acid urea, High-efficiency fertilizer, Nitrogen uptake, Nitrogen loss, Nitrogen footprint, Field lysimeter

25	Lokonon & Egbendewe	2022	Global warming, intermediary market power, and agricultural exports: Evidence for cotton and cashew nuts in West Africa	<i>Studies in Agriculture Economics</i>	Market power / Environmental impact	Climatic change, Intermediary market power, Monte Carlo simulations, Price endogenous partial equilibrium, Agricultural exports
26	Lu, Jia, Lev, Zhang, Gao, Zhao, et al.	2021	How to understand “salable fake goods” and “unsalable quality goods”? An insight from the view of quality responsibility and consumers’ brand loyalty	<i>Technology in Society</i>	Sustainable innovation / Branding / Product quality	Quality responsibility, Consumer loyalty, Technology commitment, Corporate reputation, Brand identification
27	Merlino, Borra, Bargetto, Blanc, & Massaglia	2020	Innovation towards sustainable fresh-cut salad production: Are Italian consumers receptive?	<i>AIMS Agriculture and Food</i>	Information asymmetry / Environmental impact	Best-worst scaling, Consumer preferences, Fresh-cut salads, Purchasing decision, Sustainability claims
28	Mézes, Szenteleki, & Gaál	2017	Simulation model for sour cherry product lines	<i>Computers and Electronics in Agriculture</i>	Sustainable innovation	Product line, Sector model, Decision support system, Sour cherry
29	Ming, GuoHua, & Wei	2021	Study of the game model of e-commerce information sharing in an agricultural product supply chain based on fuzzy big data and LSGDM	<i>Technological Forecasting & Social Change</i>	Information asymmetry / Product quality	Agricultural product supply chain, Evolutionary game, Information sharing, Fuzzy big data, LSGDM, GDM
30	Nassyrova, Yessymkhanova, Issayeva, Omarkhanova, Niyazbekova, Berzhanova, et al.	2020	Kazakhstan meat industry analysis: Import substitution, delivery and statistics	<i>Entrepreneurship and Sustainability Issues</i>	Competitiveness / Product quality	Competitiveness, Meat production, Innovation, Import substitution strategy, State regulation
31	Pinedo-López, Baena-Navarro, Carriazo-Regino, Urrea-Ortiz, & Reyes-Guevara	2024	Sustainability strategies: A proposal for food sector SMEs, based on the integration of life cycle assessment and ESG strategies	<i>Journal of Infrastructure, Policy and Development</i>	Sustainable innovation / Environmental impact	Sustainability, SMEs, Life cycle assessment, ESG, Clean technologies, Competitiveness, CO2 emissions
32	Pratama & Saragi	2018	Cassava quality classification for tapioca flour ingredients by using ID3 algorithm	<i>Indonesian Journal of Electrical Engineering and Computer Science</i>	Product quality	Algorithm, Cassava, ID3, Image, Processing

33	Uyeh, Asem-Hiablie, Park, Kim, Mikhaylov, Woo, et al.	2021	Could Japonica rice be an alternative variety for increased global food security and climate change mitigation?	<i>Foods</i>	Product quality / Environmental impact	Rice cultivation, Rice carbon emissions, Hidden hunger, Parboiling, Rice quality, Rice preference
34	Velásquez & Banchón	2023	Influence of pre-and post-harvest factors on the organoleptic and physicochemical quality of coffee: A short review	<i>Journal of Food Science Technology</i>	Product quality	Cofea arabica, Cofea canephora, Organoleptic quality, Coffee
35	Verstraeten, Heeremans, Geuens, & Vermeir	2023	How online grocery shopping drives private label food purchases	<i>Journal of Business Research</i>	Labelling	Shopping channel, External product cues, Heuristics, Store brands, Grocery shopping
36	Villas-Boas, Bonnet, & Hilger	2021	Random utility models, wine and experts	<i>American Journal of Agricultural Economics</i>	Information asymmetry / Product price / Product quality	Counterfactual simulations, Expert opinion, Field experiment, Information, Labels, Market power, Product attributes, Product differentiation, Random utility models, Structural random coefficients discrete choice models, Structural supply models, Welfare changes, Willingness-to-pay, Wine
37	Zhang & Yang	2022	Influence of greenwashing strategy on pricing: A game-theoretical model for quality heterogeneous enterprises	<i>Proceedings of the 3rd International Conference on Green Energy, Environment and Sustainable Development</i>	Market power / Product quality / Competitiveness	Greenwashing behavior, Product quality, Success rate, Pricing decisions
38	Zhang, Bai, & Wang	2024	Green vs. brown: Climate risk showdown – who’s thriving, who’s diving?	<i>Journal of International Money and Finance</i>	Market power	Climate risk, Green firms, Brown firms, Cash flow
39	Gil, Ruiz, Escrivá, Font, & Manyes	2017	A decade of Food Safety Management System based on ISO 22000: A GLOBAL overview	<i>Revista de Toxicología</i>	Certification	Food safety, ISO 22000, HACCP, Food processing, Food services
40	Sujianto, Pribadi, Saptati, Mahendri, Santoso, Sondakh, et al.	2024	Assessing Indonesian nutmeg commodity trade competitiveness and developing sustainable strategies in the global market	<i>Agris on-line Papers in Economics and Informatics</i>	Competitiveness / Product quality	Trade performance, Competitiveness, Comparative advantage, Nutmeg

41	Xu, Sun, Fan, Teng, Xiong, Zhu, et al.	2017	The brewing process and microbial diversity of strong flavour Chinese spirits: A review	<i>Journal of the Institute of Brewing</i>	Product quality	Chinese Baijiu, Strong flavour Chinese spirit, Microorganism, Brewing process
42	Vazquez & Balderas	2023	Sustainability and wine tourism: New challenges and opportunities for a more conscious consumer – The Case of Gramona Wineries	<i>Handbook of Research on Sustainability Challenges in the Wine Industry</i>	Product quality	-
43	Maciel-Silva, Buller, Gonçalves, Rostagno, & Forster-Carneiro	2020	Sustainable development in the Legal Amazon: energy recovery from açai seeds	<i>Biofuels, Bioproducts & Biorefining</i>	Product quality	Açaí seeds, Bibliometric analysis, Green energy, Bioeconomy
44	Surucu-Balci & Tuna	2024	Investigating logistics-related food loss drivers: A study on fresh fruit and vegetable supply chain	<i>Journal of Cleaner Production</i>	Food loss & waste	Food loss, Food loss drivers, Fruit and vegetable supply chain, Logistics activities, 24 MCDM, Turkey
45	Kazancoglu, Ekinici, Mangla, Sezer, & Kayikci	2021	Performance evaluation of reverse logistics in food supply chains in a circular economy using system dynamics	<i>Business Strategy and the Environment</i>	Food loss & waste / Environmental impact	Reverse logistics, System dynamics, Green business performance and environmental impact, Food supply chain, Circular economy
46	Riesenegger & Hübner	2022	Reducing food waste at retail stores: An explorative study	<i>Sustainability</i>	Food loss & waste	Assortment, Forecasting, Inventory management, Fresh products, Sustainability
47	Amicarelli & Bux	2021	Food waste measurement toward a fair, healthy and environmental-friendly food system: a critical review	<i>British Food Journal</i>	Food loss & waste	Food waste, Food safety, Food security, Food waste measurement, Nutritional security

Source: Authors'elaboration

Table 2 – Main themes present in articles reviewed

Theme	Articles
Product quality	Bataineh et al., 2024; Federici et al., 2021; Gerber et al., 2024; Gilbert et al., 2023; Ginting & Malik, 2020; Hong, 2016; Küçükğöz & Trzaskowska, 2022; Liu & Zhang, 2020; Lu et al., 2021; Ming et al., 2021; Nassyrova et al., 2020; Pratama & Saragi, 2018; Uyeh et al., 2021; Velásquez & Banchón, 2023; Villas-Boas et al., 2021; Zhang & Yang, 2022; Sujianto et al., 2024; Xu et al., 2017; Balderas-Cejudo & López, 2023; Maciel-Silva et al., 2022.
Environmental impacts	Berry, 2015; Bruce & Faunce, 2015; Hartling, 2019; Edenbrandt & Lagerkvist, 2024; Faunce & Bruce, 2016; Glare & O'Callaghan, 2019; Iacovides & Vrettos, 2022; Kazancoglu et al., 2021; Küçükğöz & Trzaskowska, 2022; Kulikova & Kondratenko, 2024; Liu & Zhang, 2020; Lokonon & Egbendewe, 2022; Merlino et al., 2020; Pinedo-López et al., 2024; Uyeh et al., 2021.
Labelling/Branding	Boncinelli et al., 2023; Hartling, 2019; Gerber et al., 2024; Hong, 2016; Kulikova & Kondratenko, 2024; Lu et al., 2021; Verstraeten et al., 2023.
FWL	Amicarelli & Bux, 2021; Edenbrandt & Lagerkvist, 2024; Kazancoglu et al., 2021; Porter et al., 2018; Riesenegger & Hübner, 2022; Surucu-Balci & Tuna, 2021; Pietrangeli et al., 2023.
Competitiveness	Bataineh et al., 2024; Gilbert et al., 2023; Iacovides & Vrettos, 2022; Nassyrova et al., 2020; Sujianto et al., 2024; Zhang et al., 2022.
Sustainable innovation	Basso et al., 2024; Gazdecki et al., 2021; Lu et al., 2021; Mézes et al., 2017; Pinedo-López et al., 2024.
Certification	Ab Talib, 2017; Corticeiro et al., 2024; Gil et al., 2017.
Market power	Lokonon & Egbendewe, 2022; Zhang et al., 2024; J. Zhang et al., 2022.
Information asymmetry	Merlino et al., 2020; Ming et al., 2021; Villas-Boas et al., 2021.
Product price	Hong, 2016; Villas-Boas et al., 2021.
Fertilization	Hossain et al., 2023; M. Liu et al., 2024.
Packaging	Federici et al., 2021.

Source: Authors'elaboration