



The 30th

Annual International Conference of ISDRS on Sustainable Development Research

**Linking Futures of Mountain and Ocean: Rescuing
the SDGs 2030 for Sustainable Livelihood**

PROCEEDINGS

June 10-14, 2024 | Kathmandu, Nepal

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Message from the Vice-Chancellor

With deep satisfaction and academic pride, I present this message as part of the proceedings of the 30th Annual Conference of the International Sustainable Development Research Society (ISDRS), successfully hosted in Kathmandu, Nepal from 10–14 June 2024.

Mid-West University was privileged to host this global event alongside Nepal Open University with Resources Himalaya Foundation as the secretariat, and esteemed national and international partners. The conference welcomed 300 participants from 47 countries, with 318 abstracts received from across five continents—making this event a truly global forum for sustainable development discourse.

Set against the stunning natural beauty of Nepal, the conference embraced the timely and powerful theme: “Linking Futures of Mountain and Ocean: Rescuing the SDGs 2030 for Sustainable Livelihood.” This theme reflected Nepal’s unique ecological and cultural context and emphasized the vital interconnections between mountain ecosystems and oceanic health, from glacial rivers to coastal livelihoods.

The eleven conference tracks spanned a wide spectrum—from biodiversity and climate resilience to sustainable cities and digital transformation. Each track fostered vibrant academic exchanges and practical reflections. These proceedings now encapsulate that rich body of knowledge and represent a milestone in our shared journey toward sustainability.

We extend our heartfelt thanks to the ISDRS community, the organizing committee, and every contributor. It is our sincere hope that these proceedings will continue to serve as a valuable resource for scholars, institutions, and change makers working to realize the promise of the SDGs—locally, regionally, and globally.

Prof. Dhruba Kumar Gautam, PhD
Vice-Chancellor, Mid-West University
Surkhet, Nepal

Vice-Chancellor

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Message

It is with immense pride and pleasure that I share this message in the proceedings of the 30th Annual International Conference of the International Sustainable Development Research Society (ISDRS), held in Kathmandu from 10–14 June 2024.

As a co-organizing institution, Nepal Open University was honored to play a vital role in convening this globally significant conference—one that brought together over 300 participants from 47 countries, with 318 abstracts submitted from more than 50 countries. This remarkable gathering of scholars, scientists, development professionals, and students truly reflected the multidisciplinary and international essence of ISDRS.

The theme of the conference—"Linking Futures of Mountain and Ocean: Rescuing the SDGs 2030 for Sustainable Livelihood"—deeply resonated with our national and institutional priorities. The dialogues underscored how sustainability is not merely a goal but a way of life—long practiced by indigenous communities. The rich discussions and collaborations explored sustainability from both natural and social science perspectives, bridging global aspirations with local realities.

Nepal's unique geography and cultural wealth provided an ideal backdrop for the diverse conference tracks—from climate change and energy to sustainability in the Himalayan region. These proceedings now serve as a lasting testament to that knowledge exchange and to the collective will to achieve the Sustainable Development Goals (SDGs) through research, innovation, and inclusive collaboration.

We are grateful to the ISDRS Secretariat, the organizing committee, and all contributing partners for their dedication. May this volume of proceedings continue to inspire scholarship, policy action, and global partnerships for a more sustainable future.

Professor Shilu Manandhar Bajracharya, PhD
Vice-Chancellor

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Preface and Acknowledgements

The International Sustainable Development Research Society (ISDRS) held its 30th annual international conference in Kathmandu, the capital of the Himalayan nation of Nepal. The conference marked a significant milestone in advancing the global sustainability agenda. Hosted in a hybrid format, the conference brought together over 250 participants from 47 countries, representing one of the most extensive international gatherings in the post-COVID-19 "new normal."

The conference was inaugurated by the Vice President of Nepal, while the Deputy Prime Minister and the Minister for Foreign Affairs participated in the valedictory session, underscoring the national significance of the event.

Nepal's new universities Mid-West University and Nepal Open University jointly hosted the conference. They established an inclusive academic platform by engaging five recently founded universities from across the country: Agriculture and Forestry University, Far-Western University, Madhesh University, Purbanchal University, and Rajarshi Janak University. This collaborative initiative laid the groundwork for stronger inter-university cooperation across Nepal.

In addition to the universities, the conference was supported by 12 key institutions, including the University Grants Commission (Nepal), the National Trust for Nature Conservation (Nepal), UNDP, and UNESCO. Serving as the conference secretariat, the Resources Himalaya Foundation played a central role in coordinating logistics and mobilizing resources.

The conference featured 220 research contributions across 10 thematic tracks, showcasing the interconnected and multifaceted nature of sustainable development. It highlighted the critical need for inter- and transdisciplinary collaboration, localized strategies, and inclusive approaches. Of particular significance was the strong participation of scholars from the Global South and women researchers, whose contributions emphasized the importance of addressing context-specific sustainability challenges and solutions.

The event called for the strengthening of research cultures in emerging academic institutions, improved science communication, and deeper engagement with issues of equity and planetary boundaries. These themes are especially relevant for Nepal—a Least Developed Country facing severe climate vulnerability. Melting Himalayan glaciers, rising frequency of wildfires, and increasingly erratic weather patterns are threatening livelihoods, particularly in rural farming

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communities. The timing of the conference was pivotal, as Nepal aspires to graduate to a developing nation status amidst these mounting sustainability challenges.

The conference served both as a challenge and an opportunity. It identified the urgent need to build robust platforms and mechanisms for collaboration among key actors in the Global South and emerging economies, reaffirming their crucial roles in achieving the Sustainable Development Goals (SDGs).

One of the key outcomes of the conference was the adoption of the Kathmandu Communiqué, which emphasized the importance of integrating the SDGs with planetary boundaries and understanding the socio-economic dimensions of sustainability—particularly equity, inclusivity, and the impacts of sustainability transitions on vulnerable populations.

We sincerely thank all partner organizations, volunteers, researchers, and scholars whose commitment and contributions were instrumental in making this conference a meaningful and memorable milestone in the global dialogue on sustainable development.

We extend special appreciation to the track reviewers, paper and poster presenters, and all participants, whose active engagement played a vital role in the conference's success.

Prof. Sjors Witjes, PhD
President
ISDRS 2024

Prof. Dinesh Bhujju, PhD
Convener
30th ISDRS Conference 2024 Kathmandu

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How Can Design Discipline Contribute to the Sustainable Food System Transformation? A Review of Research Projects in the Italian Context

Chiara Battistoni¹, Paolo Capovilla¹

¹*Università Iuav di Venezia, Venezia, Italy*

Abstract

The road for the food system toward a more sustainable scenario requires consideration of all the stages of the food chain, with cooperation from all the disciplines to which the design can contribute. A literature review is conducted to individuate research projects, limited to the Italian context, in the design field for the agri-food sector, where outputs can be diverse from objects. The goal is to understand how the design field can argue for a more sustainable scenario for the food system. The results give interesting insights into practices and actions just applied and reveal that most of them integrate reasoning over the food system's sustainability. Afterward, the results of the review are applied to reflect in a specific research context around the production of two typical Italian products in two different territories of the Veneto region: the hills at the foot of the mountains Dolomiti for Prosecco wine and a part of the big plain Pianura Padana on the banks of river Adige for Lusina salad. This paper gives insights for a reflection on the design for a sustainable food system and a territorial development that respects the planetary boundaries, ecological common goods, and social conditions of citizens.

Introduction

According to Clark *et al.* (2020), global food system emissions could preclude the targets set to prevent climate change disasters. Indeed, the entire food chain creates 26% of anthropogenic GHG emissions, where food production is the most impactful stage of the chain (Poore & Nemecek, 2018). The road for the food system transformation towards a more sustainable scenario, therefore, requires consideration of all the stages of the food chain, with great effort and cooperation from all the disciplines to which the design can contribute. A general overview of the contribution of design discipline in the food field has been defined food design (Massari, 2017; Bassi, 2015). Thanks to the strict relationship among food and the territory, also *design for territories* (Parente & Sadini, 2017) subfield can contribute.

This paper focuses on the research in the design field for the agri-food sector, providing a literature review of the main research projects carried out in Italy in the last 10 years, where sometimes the outputs are not only the design of an artefact, which is the traditional design output. The goal is to understand how the design field can argue for a more sustainable scenario for the food system, thanks to the many diverse outputs that the research in this discipline can provide.

Finally, in the last chapter there is a reflection on the contribution of design in a specific research scenario. The review's results are indeed applied to two different territories of the Veneto region, where a group of multidisciplinary researchers is working: Vittorio Veneto municipality placed in the hills at the foot of the mountains Dolomiti prealpi where Prosecco wine is produced; Lusina municipality, a part of the big



plain Pianura Padana on the banks of river Adige where Lusina salad is cultivated. The location of the two case studies is related to mountain (pre-alps) and river contexts, core topics of the conference, which can potentially contribute to the discussion over a more sustainable future for these territories. In conclusion, this paper gives insights into reflecting on the design for a sustainable food system and territorial development that respects the biophysical thresholds of planetary boundaries, ecological common goods, and citizens' social conditions.

SDGs involved: 2.4; 6.3; 12.2, 12.3, 12.5, 12.8; 13.3; 14.1; 15.1, 15.3.

This study is part of a broader research project that involves a group of multidisciplinary researchers at Università di Venezia, conducted in 2023-2024.

Literature Review

This paragraph presents the current literature situation on the relationship between food, design, and sustainability.

Design and Food

The contribution of design discipline in the food field has been defined *food design* by some authors. Massari (2017) defined the differences between food studies and food design studies as: “*studies on agri-food production (food studies) and design studies relating to food (food design studies) are two relatively new areas of research*” (Massari, 2017). This new area of design, having today also a dedicated journal, the International Journal of Food Design, has become an educational topic, defined food design education (Massari, 2017). Bassi (2015), in his book on the history of design of food as a product in Italy entitled “Food Design”, reminded that in the Italian context, the Italian designers internationally famous haven't forgotten to work in the food sector, an important economic sector and an important part of the national culture. Designers have worked on new shapes of pasta, famous packaging, advertising (Carosello), cutlery and crockeries, and more. He divided food design into: design with food - related to the way to prepare dishes -; design for food - the modalities of consumption and service -; design of food - as a design product - (Bassi, 2015).

Food is also an important topic dealt by other disciplines as planning. Indeed, the relationship among food and space is strong (Lazzeroni *et al.*, 2023) and emerged several times in the food system planner (Soma & Wakefield, 2011).

Thanks to the strict relationship between food and the territory, also design for territories (Parente & Sediti, 2017) design subfield can contribute to the reasoning about the relationship between food and design. Parente & Sediti (2017) recognized the division among: design in the territory to enhance local cultural products, or resources related to environmental, historical and cultural heritage - works on city, place, country fruition -; design of the territory insists on products, communication systems and services related to local organisations - works on local, territorial, national identity -; design for territories, a field of study considering the territory as a design object - works on design and crafts, design and local

productive districts, made in -(Parente & Sedini, 2017). They are *“three approaches that gradually expand the observation from the territory as a context of design, to an object of intervention and then to a relational system”* (Parente & Sedini, 2017).

Subsequently, another Italian scholar working on the food and the territory is Catania (2011 a) who identified the role of design in the valorization of the local production and of innovation of the territorial capital. One of her case studies is the project on the local food system in Sicily (Catania, 2011 b). Catania (2017 a, p.84) strictly related food and territory *“food tells the story of the territory and its products, the rituals and the symbols of the gastronomic tradition. Today, food in a territory also becomes an expression of values to be promoted and design can bring new opportunities. The design culture, using its tools, starts a virtuous cycle between product and territory and can carry out the regeneration of the territory and the sustainable development of economic activities at local level”*. In her works the relation between food, design and sustainability appeared.

Food, Design and Sustainability

Due to the high impact of the food systems on the planetaries boundaries and consequently climate change (Nature Food, 2023), there is the need to restructure food systems towards sustainability. In the European context, this need is addressed by the Farm to Fork strategy, with the aim to *“designing a fair, healthy and environmentally-friendly food system”* (EC, 2020), where all the stages of the food chain should have a neutral or positive climate and environmental impact (EC, 2020). At the world level, in the Sustainable Development Goals set by United Nations, food is related to two SDGs: SDG 2 “Zero Hunger”, and in the third target of SDG 12, “Responsible consumption and production” setting target for halving global per capita food waste and food losses by 2030.

Design in general is questioning its role, in particular in the research area of design for sustainability, developing from end-of-life considerations to product design for sustainability and circularity, and product-service-systems (Ceschin & Gaziulusoy, 2016). Circular design is also another set of strategies to design for the circular economy.

Additionally, contributions over food design also discuss the need for sustainability in this sector. The Ellen MacArthur Foundation, known for circular economy studies, defines the circular design for food as: *‘..to design for positive consumer, farmer, economic, and environmental outcomes, the principles of the circular economy can be applied to the way we design food...(...)..In order to maximise benefits in the food system, circular economy principles should be applied across all dimensions of food design, from product concept, through ingredient selection and sourcing, to packaging...’* (Ellen MacArthur Foundation, 2021). Moreover, it identifies four circular design opportunities for food: diverse - diversity of animal and plant varieties and species as ingredients -; lower impact - ‘quick win’ ingredient that have fewer negative impacts; upcycled - transforming inedible food byproducts into new ingredients; regeneratively produced - regeneratively produced ingredients. Also, Fassio identifies that food can play an important role in the transition towards a circular economic paradigm. First, Fassio & Tecco (2018) in their book analysed several implemented cases of circular economy for food. Moreover, Fassio (2021), in defining a conceptual framework for circular design in the food system, highlights the 3 C’s - Capital, Cyclicity and Co-evolution

- to offer a holistic vision of the food system's role. Capital stands for preservation and regeneration at a local level of natural capital, to protect the cultural capital, to produce a distributed economic capital; cyclicity for thinking in regenerative terms; co-evolution for the mutualistic symbiosis that is possible to find in nature. Catania (2011 a) also insisted on the importance of working with the local actors and for new sustainable production systems, citing Bistagnino (2011) who proposed the use of a systemic approach in design, theorising the Systemic Design (SD) to obtain new sustainable production systems working on the connection between output and input of production processes, eliminating wastes, as happen in nature.

Methodology

To understand how the design field can argue for a more sustainable scenario for the food system, thanks to many diverse project outputs that the research in the design field can provide, first, a literature review was conducted to discover these research projects. The review started and was limited to the Italian context for few reasons: time constraints (1 year research); agri-food in Italy is the most important economic sector - 580 billion euros in 2022 (Unioncamere, 2023) with 327 traditional registered products (MASAF, 2024); Italy is the home and the country of work of the authors so it was possible to discover more contributions also written in Italian. The review included research projects performed by Italian designers on food. The contributions were mainly found in the library for Italian books, and in the proceedings of the Italian annual assembly of the Italian Society of Design (SID). It was also used the working experience of the authors. From the first contributions found, a snowball process was applied to include more works related to these authors.

The review results help reflect on the contribution of design in this topic, giving insights for new perspectives on the design for a sustainable food system and toward a territorial development that respects biophysical thresholds of the planetary boundaries, ecological common goods, and social conditions of citizens. Afterward, the results are applied in a specific research scenario, where the group of six multidisciplinary researchers of Università Luav di Venezia, where authors are included, is working. The disciplines involved are: planning design, product design, economy and rural estimate, economic anthropology, gastronomic sciences. Precisely, the research is based on the production of two typical Italian products in two different territories of the Veneto region, where the university is located. These territories have been primarily dedicated to these products, overshadowing other activities, creating an increase in the local economy, but also by increasing environmental impacts. They are: the hills at the foot of the mountains Dolomiti prealpi where Prosecco wine is produced - with a focus on Vittorio Veneto municipality -, and a part of the big plain Pianura Padana on the banks of river Adige - Lusina municipality - where Lusina salad is cultivated.

Results and Discussion

Literature Review Results

The review finds 34 contributions about the category of design research projects, the one listed in table 1. The review moreover discovers some theoretical contributions, which are highlighted in tab. 2, and educational programs, which are highlighted in tab 3.

Table 1. Design research projects found and considered in the review

No	Reference	Research Period	Project Leader	Geographical Location of Project	Part of the Food Value Chain Involved	Main Agrifood Sector Involved	Impact on Sustainability (Environmental, Social, Economic)
1	Fassio et al., (2022)	2022	UNISG	Piedmont region (IT)	Food production, transformation, and supply	Wine, dairy, cheese, rice, water, and bovine beef	Environmental mainly - food waste and byproducts management
2	Fiore et al. (2020)	2020	Politecnico di Torino	Piedmont region (IT)	Food production (by-products)	Wine	Environmental - management of Piedmontese by-products (rice and wine)
3	Barbero & Fiore (2015)	2013	Politecnico di Torino	Torino city (IT)	Food consumption (by-products)	Coffee	Use of by-products for different businesses, particularly coffee grounds
4	Barbero & Tamborini (2012)	2007-2013	Politecnico di Torino	Cuneo, Piedmont region (IT)	Food production (by-products), distribution, packaging design	Beans	Impact on land conservation, packaging production, and optimization of material and energy flows
5	Barbero & Battistoni (2016)	2016	Politecnico di Torino	France	Food processing (by-products)	Biscuit	Sustainable production, changes in supply chains
6	Battistoni et al. (2020)	2020	Politecnico di Torino	Piedmont region (IT)	Food processing (by-products)	Hazelnut	Analysis of the transformation process and use of by-products
7	Bozzola et al. (2017)	2015	Politecnico di Torino	Italy	Food service consumption (food waste)	General	Action on leftovers, social responsibility for food waste reduction
8	Bozzola & Dal Palù (2018)	2015	Politecnico di Torino	Turin, Italy	Food transformation (food waste)	Fruits and vegetables	Food waste reduction, social inclusion, and education projects
9	Campagnaro & Ceraolo (2017)	2017	Politecnico di Torino	Turin, Italy	Food transformation (food waste)	Fruits and vegetables	Food waste reduction, social inclusion, and education projects
10	Campagnaro et al. (2020)	2020	Politecnico di Torino	Turin, Italy	Food waste awareness-raising	General	Awareness-raising on food waste with a view to circular economy and social cohesion

No	Reference	Research Period	Project Leader	Geographical Location of Project	Part of the Food Value Chain Involved	Main Agrifood Sector Involved	Impact on Sustainability (Environmental, Social, Economic)
11	Campagnaro et al. (2023)	2023	Politecnico di Torino	Turin, Italy	Food distribution network	Generic	Social sustainability through inclusion, tackling food access, and food capability building
12	Campagnaro & Bosso (2024)	2024	Politecnico di Torino	Turin, Italy	Food cooking	Generic	Social impact through food access and inclusion
13	Savina et al. (2018)	2018	Politecnico di Torino	Turin, Italy	Food production (food procurement)	Generic	Impact on public health - decrease illness through improved public food procurement
14	Kloeckl et al. (2010)	2009-2010	Università Iuav di Venezia	Veneto region (IT)	Food distribution and packaging	Salad	Environmental - use of nanotechnologies to create high-performance materials
15	Battistoni (2023)	2022-2024	Università Iuav di Venezia	National	Food service (professional kitchens)	Generic	Environmental - saving water in professional kitchens
16	Fagnoni (2018)	2018	Università Iuav di Genova	National	Tourism (wine)	Generic	Not specified
17	Trebbei (2023)	2023	Sapienza University of Rome	Rome, Italy	Food packaging	Biomaterials	Environmental - making biomaterials through everyday products and implementing symbiotic processes
18	Di Bucchia et al. (2018)	2014-2015	Università d'Annunzio di Chieti-Pescara	Pescara, Italy	Food consumption (storage, preparation, consumption)	Generic	Social - design for industrial products for food and beverages
19	Galbiati et al. (2017)	2014-2015	Politecnico di Milano	National	Food waste from consumption	Generic	Social - social communication campaign
20	Carraro et al. (2023)	n.d.	Politecnico di Milano	Reggio Emilia, Italy	Food preparation (donation)	Generic	Economic - accessibility to healthy and sustainable food systems for all

No	Reference	Research Period	Project Leader	Geographical Location of Project	Part of the Food Value Chain Involved	Main Agrifood Sector Involved	Impact on Sustainability (Environmental, Social, Economic)
21	Bianchi et al. (2023)	2019-2022	Politecnico di Milano	Milano, Italy	Food markets (municipal markets)	Fruits, vegetables, meat	Environmental and economic - food markets as circular digital hubs
22	Cioffi et al. (2021)	2021	Università degli Studi di Campania Luigi Vanvitelli	Campania region, Italy	Food waste management	Wine	Environmental and economic - recovery, reuse, and valorization of residues and by-products
23	Marti et al. (2023)	n.a.	Università di Siena and Pisa	National	Supply chain (fish)	Generic	Not explicit
24	Filippi et al. (2022)	2022	Università di Firenze	Raggiolo (Arezzo), Italy	Production	Generic	Not explicit
25	Morone & Parlato (2019)	n.a.	Università di Napoli	Napoli, Italy	Consumption	Generic	Not explicit
26	Formia et al. (2024)	n.a.	Università di Bologna	International	Food awareness	Generic	Social and environmental - responsible innovation
27	Manfra (2022)	2022	Università di Camerino	National	Agriculture (water use)	Generic	Environmental - responsible water use in agriculture
28	Manfra (2023)	n.a.	Università di Camerino	Marche and Abruzzo regions (IT)	Agroecology	Agroecology	Agroecology
29	Catania et al. (2011)	n.a.	Università di Palermo	Sicily, Italy	Packaging (typical product)	Generic	Environmental - eco-design for typical products and consumption
30	Catania et al. (2017)	n.a.	Università di Palermo	Sicily, Italy	Packaging (labeling)	Olives	Not explicit
31	Canina & Monestier (2023)	n.a.	Politecnico di Milano	National	Generic (sustainable food practices)	Generic	Environmental - sustainable food practices and natural-based coatings
32	Piselli et al. (2016)	n.a.	Politecnico di Milano	National	Packaging	Paper	Environmental - natural-based coatings for packaging

Table 2. Theoretical contributions found during the review

no	Reference	Affiliation	Part of the Value Chain Involved	Impact on Sustainability
1	Bassi (2015)	Università Iuav di Venezia	Food consumption	No
2	Catania (2017)	Università di Palermo	Food identity	Environmental – partially
3	Catania (2011)	Università di Palermo	General	Generic
4	Fassio (2021)	UNISG	General	Yes – Conceptual framework for circular design in the food system
5	Fassio & Tecco (2018)	UNISG & Università di Torino	General	Yes – Circularity in the food system
6	Massari et al. (2023)	University of Pisa	Food transformation and supply	ICT tools for monitoring ecological footprint

Table 3. Educational programs found during the review

no	Name	Typology	Institution	Language	Impact on Environmental Sustainability	Reference
1	Design sostenibile per il sistema alimentare	Bachelor degree	Università di Parma	Italian	Yes, partially	https://corsi.unipr.it/it/cdl-dssa Milano
2	Design for Food – Innovation for Circularity	Master	Politecnico di Milano	English	Yes	ign.net/en/formazioi novationne/business-design/master-circularity design-for-food/ future
3	Polito Food Design Lab	Research lab	Politecnico di Torino	Italian	Yes, partially	Ceraolo & Passaro (2019)
4	Gastronomic Science (including Design)	University	Università di Scienze Gastronomiche	English	Yes, partially	https://www.unisg.i

Regarding packaging, Bozzola *et al.* (2017) and Bozzola & Dal Palù (2018), through a didactic experience on designing products for leftovers pack and transport, the so-called “doggy-bags”, they focus on increasing meaningfulness and value perception of food resources, raising public awareness on the food waste reduction importance in an environmental, ethical, social, cultural and economic context”. In the project Memo by Veneziano (2018) it was designed a food packaging, a launch box, linked to a social project on the willingness to increase awareness on the culinary tradition of Napoli, which involved a co-design phase with many local actors. Veneziano (2018) insisted on the need to a moment of “listening” during the reading and interpretation phase of the territory. On the same topic, with a different scope, also Kloeckl *et al.* (2010) worked) in a design experience over designing for agriculture, a collaboration among Università Iuav di Venezia and Coldiretti (Italy's largest agricultural association) in the Veneto

Region. The packaging has become a technical device to conserve the salad, a barrier from external atmosphere, a way to measure the food portion, the document of a production history, and thanks to an rfid tag, it is also a way to trace the food supply chain (Kloeckl *et al.*, 2010). The project by Piselli *et al.* (2016) is on packaging, but it is more on technical aspects, to find a sustainable alternative to recyclability and compostability for greasy food, designing new prototypes using polysaccharides-based coatings.

Among the many collected works, a few were based on the exploration of processes and system to individuate by-products and explore potential use of it. Cioffi *et al.* (2021) works on the management of residues and by-products, through recovery, reuse, and valorisation of wine industry. The following projects explore how to connect different productions systems through the by-products, using SD, as evidenced by the work on hazelnut by Battistoni *et al.* (2020), beans (Barbero & Tamborrini, 2012), coffee (Barbero & Fiore, 2015), biscuits (Barbero & Battistoni, 2016), in Politecnico Torino with the lead of Barbero and Tamborrini. In the same institution emerged the work by Campagnaro & Ceraolo (2017), Campagnaro, Passaro & Stabellini (2020), Ceraolo & Passaro (2020) to fight food waste towards a new social food chain with multiple experience as The Egg of Columbus workshop and The Egg of Columbus Lab. In this context food waste is elaborated for creating new food. This group lead by Campagnaro have also worked at the Alimenta project, a design-led systemic action against homelessness-related food poverty (Campagnaro *et al.*, 2023) working more on the social sustainability through inclusion tackling food network and food capability building, and also this experience has become a didactic experience on design for social impact (Campagnaro & Bosso, 2024). In these experiences, food is treated as a design material.

Further to this, two projects have worked on the intersection among different food value chain, in Piedmont Region. Fiore *et al.* (2020), with the Innovaecofood project on rice and wine value chains, and the work of Fassio *et al.* (2022) on wine, dairy and cheese, rice, water, and bovine beef. Also, the work by Trebbi (2023), analyses the by-products of brewery, wine producer, juice bar and a coffee bar to evidence the creation of multiple new products and also a diffuse micro-factory, for circular distributed production system for microbial nanocellulose.

Some projects worked on specific topics such as water use, agroecology or health. Concerning water, Battistoni (2023)'s work focus on the relationship of design and sustainability for the food service focuses on food transformation in professional kitchens, analyses the resources involved in addition to the food, and concentrates on water for food—the food-water nexus—to understand how to design professional equipment for the circular economy scenario. Instead, the project by Galbiati (2017) on the realisation of an 'unconventional' social communication campaign worked on the consumption and waste of water. In this context, the role of design was used as a tool to interconnect different cultural, linguistic and technical skills because it can address a topic under different disciplines and communicate it in an original way. Also, Manfra (2022) worked on water, claiming for a responsible water use in agriculture, bringing examples and highlighting the need for designers to offer sensitive, breaking and radical contributions against the unsustainable logic. Manfra (2023) worked on agroecology to create positive connections between small farms, land resources and communities by introducing innovations in agricultural practices that do not depend on the surrounding socio-economic and cultural conditions. In this research, design plays a facilitating role in combining organisations and training groups that come together spontaneously, combining their ways of working into a single integrated process. Regarding health, the research project

by Canina and Monestier (2023) aims to imagine new design processes to support a more sustainable food system than the current model, following the 'Design Futures' approach, focusing on a case study on the relationship between food and health that shows the customisation of food according to lifestyle, as witnessed by meal replacements and bioactive diets. Also, in this case is discussed the potential applications of digital technologies to the food system. Savina (2018) on the impact of food production on public health, developed systemic strategies for a diffused and transversal prevention plan.

Following this, some projects worked on the communication part of projects, such as Catania (2017b) designing a label of packaging that can tell the quality of the product, the company philosophy, and the territorial peculiarities. Morone & Parlato (2019), analysed how food in Napoli, and the communication around it, is an identity that can create exploitation and belonging. About food as territorial identity, Fagnoni (2018) highlighted that in the wine sector, architecture and design create markers, and the cellars and tasting places have the role of territorial-hub to promote territorial activities and also tourism. A communication project is also the community map by Filippi *et al.* (2021), a particular tool drawn up and constantly updated by the local population, who collects the social and cultural aspects of a particular place. It is a project resource to preserve and pass on knowledge, traditions and values, and a reservoir of ideas for new forms of planning, development and innovation. The project by Galbiati (2017), as seen above, conjugates communication and education.

Several projects worked on the inclusion of the digitalization part in projects. Bianchini & Maffei (2023) consider food markets as circular digital hubs, worked on a Food Market 4.0 designing and prototyping three product-service system solutions focused on waste prevention, digitisation of markets (wi-fi, tracking, data management and analysis, smart checkouts and lot solutions) and to encourage interaction between markets and neighbourhoods (from food apps to home delivery). Also, Marti *et al.* (2023), focuses on the potential of design enabled by digital technologies, highlighting the need to educate future designers to adopt a systemic perspective, designing new solutions involving stakeholders, following prototyping techniques, evaluation methods and field testing.

Formia *et al.* (2021) uses design as an instrument in the service of responsible nutrition, designing food products, packaging and consumption systems to meet the digital and green transitions, working with South American universities.

Projects worked also on the social sustainability of projects as the project by Di Bucchianico (2017) that worked on Design for All to identify and develop new ideas for 'inclusive' industrial products for the storage, preparation or consumption of food and beverages. In a discussion of social justice and how it is affected by food, we must reconsider the fundamental right to accessibility to healthy and sustainable food systems for all. This topic was discussed by the authors Carraro *et al.* (2023), analysing in depth the issue of food donation to identify design opportunities and developed ideas to improve the circularity of the food system in specific territories. The co-design process was essential.

Contribution of Design for a Sustainable Food System and a Sustainable Territorial Development

According to this review it is possible to understand that the design in the last years have moved to the pure design of artefacts, but it is enlarging its scope with projects that involve many other aspects. In the

food sector researches on design are considering by-products used as resources for new products, the design of local and circular food systems, actions for education on food systems, the integration of digital technologies for a sustainable transformations, the use of a participatory design approach, the attention of social sustainability working on the redistribution of food surplus, actions to reduce homeless food poverty and social eating activities. Many of them included reflections over food system's sustainability and circularity.

In particular, according to these research projects, design can intervene in:

- promotion of territorial heritage and related food products (design for territory);
- sustainable and communicative packaging;
- design with food as a “design material”, for valorization of agri-food by-products used as resources for new products creating circular local production system;
- understanding the local food system to act for a new system more sustainable (ex: act on the use of water for food production or cooking) thanks also to data visualisations;
- integration of digital innovations for sustainable transformations;
- communication campaigns, to reduce food waste or create a food education;
- Workshop to co-design processes, stimulate innovation processes and participatory design in food experience.

Specific Application to two Veneto Region Territories

The research especially wants to understand the contribution of design in a specific research scenario where a group of multidisciplinary researchers is working. This context is the geographical area characterising the production of two typical Italian products in two different territories of the Veneto region. These territories have been primarily dedicated to these products, overshadowing other activities and also creating environmental impacts. We are referring to the hills where Prosecco wine is produced - a focus on the municipality of Vittorio Veneto -, and a part of the big plain Pianura Padana on the banks of river Adige - Lusia municipality - where Lusia salad is cultivated

Vittorio Veneto (TV) and Prosecco area

Vittorio Veneto is a city of around 27.000 inhabitants in Treviso province in Veneto region (IT) located in the hills at the foot of the mountains Dolomiti prealps. For the 53, 92% the territory is covered by wooded areas, 28.51% by agricultural surfaces, 16.42% urbanised areas, 1.15% rivers, streams and lakes. As can be seen from fig. 1, Vittorio Veneto is included, to the south, in the Controlled and Guaranteed

Designation of Origin of Prosecco di Conegliano and Valdobbiadene, the "historic" production area of Prosecco, and since 2019, the Municipality has been part of the UNESCO site "The Hills of Prosecco of Conegliano and Valdobbiadene", as core, buffer and commitment zone. Viticulture plays a particularly significant role here, so much so that 36.38% of the agricultural territory is covered, in 2020, by vineyards, the second most important use of agricultural land after herbaceous covers. In the wake of the international economic success of Prosecco (currently the most exported Italian wine in the world), Vittorio Veneto has become, in recent years, one of the municipalities of the Conegliano Valdobbiadene DOCG which has recorded the greatest increase in vineyard surface area, with important consequences

in terms of landscape-territorial modifications (Basso, 2019). If in 2015, for example, the vineyard surface amounted to approximately 915.91 hectares, it increased by 17.29% between 2015 and 2020 (see fig. 2, left). Of the 196.74 hectares of new vineyard planted in the five-year period, 68.96% replaced land previously used for arable land, 20.10% woods and 4.29% meadows.

In the DOCG Prosecco territory, although predominantly made up of vineyards, also hosts other products that make up the local gastronomy. In these hills, in fact, a historical and dedicated production is attributed to the cultivation of olive trees, from which an excellent quality extra virgin olive oil is obtained. Additionally, chestnut trees grow on the hills, and chestnuts have a PGI label Throughout the Pedemontana trevigiana, dairy products and animal-based preparations are also abundant as grilled meat and preparations such as braised meats always accompanied by polenta. Along them there are also appreciated cheeses, all certified PDO and this list is further enriched by a long tradition of herbs, snails, and mushrooms. The basket of products mentioned above confirms the fact that these territories can offer different types of production and that in addition to Prosecco, many other local and indigenous wines are drunk. (Proloco Vittorio Veneto, n.a.)

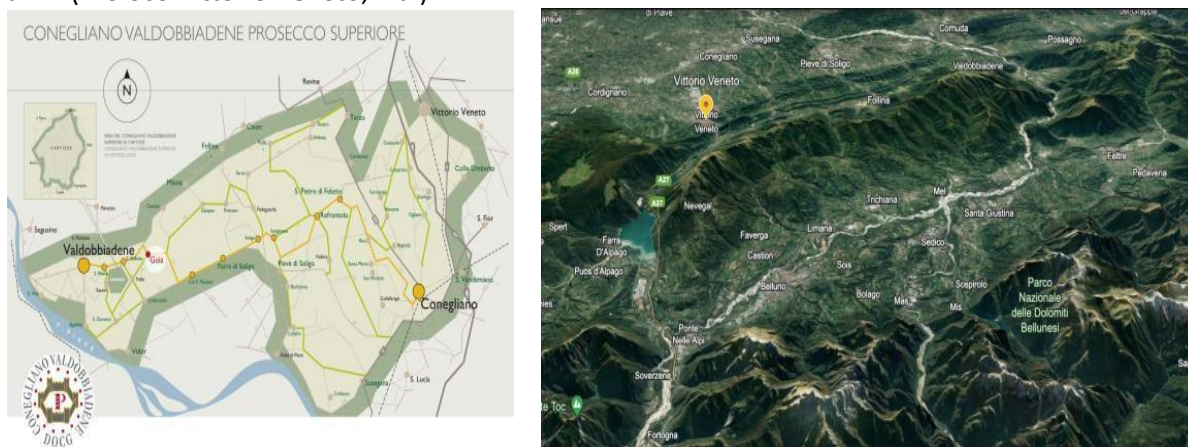


Figure 1. The area of Prosecco. On the left the area of the Prosecco Conegliano Valdobbiadene DOCG. On the right the area seen from google earth

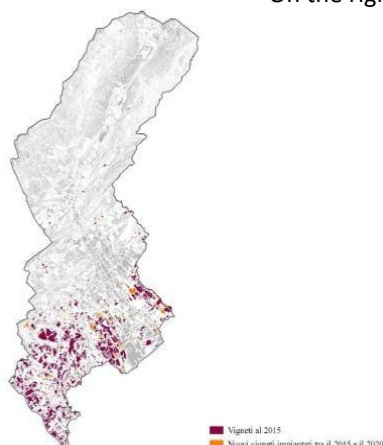


Figure 2. Vittorio Veneto municipality. On the left the evolution of the vineyard surface between 2015 and 2020. Elaboration by Matteo Basso on AVEPA data. On the right a collage of food and beverage products in the area.

In this context, the design can contribute to create a coordinate image of the Prosecco area, including also the Vittorio Veneto area which many times resulted on the corner of the map (see fig. 1, left). Moreover, it is possible to work on the promotion of the long territorial heritage (design for territory) and also to the other food products that belong to the heritage, as the products of the woods, creating also new maps as in the work by Filippi *et al.* (2021). In addition, using a SD approach, it is possible to visualise and understand the local food system, to individuate the nodes and intervention points on where to act for a new system that is more sustainable. Individuating, for example, the main waste stream produced in the area, the actors and stakeholders that are already existing and the ones that are needed for a different management. In addition, a SD approach can also help to understand the environmental impact of the Prosecco production on the natural ecosystem as the pollution of air and water. Once the new resources on where to work are defined, there is the possibility to work to create new foods or the new products (as created from by-products) and then promote the new products, working on the packaging and the communication. This can help to contribute to move the attention to not only to the product Prosecco.

Lusia (RO)

Since the 1930s in Lusia there were the pedoclimatic conditions suitable for the production of vegetables and salads, also due to the presence of the Adige River which crosses the territory. “Lusia Salad”, with a hundred-year history, has the European record of being the only one protected by the I.G.P. mark. (Protected Geographical Indication) obtained in 2009. Its quality derives mainly from its geographical production area and the particular combination of some pedoclimatic factors of the area, such as atmospheric humidity, the presence of constant water along the canals and the presence of loose fertile soils rich in mineral salts, which give it a perceptible flavour. In fact, the soil is characterised by a superficial layer of sand brought by numerous floods (Adige) and with a mixed texture towards the hinterland, with constant humidity and permeability due to the high-water table and artificial canals. In an area of 1.760 ha, the arable land in irrigated areas is around 1.310 ha. The fields for salad are about 110 ha and the open field for other vegetables are around 300 ha. There is also production of soy, wheat, corn, barley. Today fruit and vegetable cultivation is the dominant activity with a total of approximately 150 hectares of greenhouses.



Figure 3. The Lusia area. Left: land use of the area. In light green the fields dedicated to the arable land. Elaboration of Alberto Bonora. Right: picture of the greenhouses and of the Lusia salad

Also, in this context, the design can contribute to both the communication of the principal product, for a coordinate image of the area, and also to give a window to other food products that are possible to produce in this area thanks to the specific characteristics. The SD approach can help to visualise and understand the local food system, to individuate the nodes and intervention points on where to act for a new system that is more sustainable, highlighting resources consumption and by-products produced, acting as in the project of beans cultivation by Barbero and Tamborrini (2012). It is possible to work both with the producers, but also in the transformation phase, where the salad is cleaned or other vegetables and fruits are transformed, and in the food consumption. To increase the traceability with the use of packaging, it is possible to implement a project like the one by Kloeckl *et al.* (2010). For a more responsible water management in this context, it is possible also to implement some of the examples that Manfra (2022) highlighted in his contribution over a more responsible use of water in agriculture, or using the framework by Battistoni (2023) to work on food preparation (e.g. vegetables washing) both in food service and in domestic contexts.

Conclusion

This paper, thanks to the review of Italian research projects, gives insights for a reflection on the design for a sustainable food system and a territorial development that respects biophysical thresholds of the planetary boundaries, ecological common goods, and social conditions of citizens. Moreover, design can help to design for the valorization of the local production and of innovation of the territorial capital, enhancing local culture, thanks to artefacts and communication practices.

In this scenario, the designer can apply different skills that can be acquired over the original contribution on product development, graphics and communication. This professional figure can be involved in many parts of the food system to enable the system transformation. In particular, this professional can have the tools to assess circular economy opportunities at the systems level, envisioning future worlds and using a tangible vision thanks to artefacts. In addition, from being explorers in the preliminary research and framing phase, the designer then can play the role of facilitators and mediators between actors, conducting co-design processes for innovation (product, process, service) and guiding the collective creativity.

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