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How Can Design Thinking Improve Food Sustainability in the Minho Region? A Multi-Actor Perspective¹

Como Pode o Design Thinking Melhorar a Sustentabilidade Alimentar na Região do Minho? Uma Perspectiva Multi-Ator

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Abstract

Using the Design Thinking methodology and the multi-actor approach, the aim was to find an innovative and collaborative perspective that reconciles gastronomic traditions with health and sustainability criteria. To this end, two workshops were held, bringing together 12 participants from the agri-food ecosystem in the Minho region. We concluded that the topics discussed and the solutions proposed highlighted the intrinsic relationship between local production and sustainability, emphasizing that the proximity between producer and consumer translates not only into a lower carbon

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footprint but also into the socio-economic and cultural enhancement of the region. The richness of Minho products, from their flavors, textures, and stories, deserves to be celebrated but also protected and adapted to the new challenges of today's society. This study has a very original and multidisciplinary approach. Integrating different actors, specialties, and perspectives has promoted a rich exchange of knowledge and experience, materialized in convergent ideas. To improve the future of enogastronomy, the design thinking approach is used for the first time in literature to promote integrated solutions in the Minho food system.

Keywords: Enogastronomy; Design Thinking; Multi - actor approach, Problem-solving, Sustainability

*JEL Code:*R00; Z39; R10

Resumo

Recorrendo à metodologia Design Thinking e à abordagem multi-atores, pretendeu-se encontrar uma perspetiva inovadora e colaborativa que conciliasse as tradições gastronómicas com critérios de saúde e sustentabilidade. Para tal, foram realizados dois workshops, reunindo 12 participantes do ecossistema agroalimentar da região do Minho. Concluímos que os temas discutidos e as soluções propostas evidenciaram a relação intrínseca entre a produção local e a sustentabilidade, sublinhando que a proximidade entre produtor e consumidor se traduz não só numa menor pegada de carbono, mas também na valorização socioeconómica e cultural da região. A riqueza dos produtos minhotos, desde os seus sabores, texturas e histórias, merece, mas também protegida e adaptada aos novos desafios da sociedade atual. Este estudo tem uma abordagem muito original e multidisciplinar. A integração de diferentes atores, especialidades e perspetivas permitiu uma enriquecedora troca de conhecimentos e experiências, materializadas em ideias convergentes. De facto, para melhorar o futuro da enogastronomia, a abordagem do design thinking é utilizada pela primeira vez na literatura para promover soluções integradas no sistema alimentar do Minho.

Palavras-chave: Enogastronomia; Design Thinking; Abordagem multi-atores, Resolução de problemas, Sustentabilidade.

*Código JEL:*R00; Z39; R10

1. INTRODUCTION

Food is an essential commodity that reflects a way of life and social and cultural heritage. Food influences people's health, lifestyles, and habits (Cavicchi and Stancova, 2016). Still, it also considerably impacts other production systems, such as agriculture, water, and waste, affecting the entire ecosystem (Ritchie, Rosado, and Roser, 2022).

Innovation and knowledge creation in the agri-food and food value chains have become necessary for regional stakeholders looking for new production and business opportunities (Gardeazabal et al., 2023). New actors are increasingly involved in emerging agro-food value chains: new farmers' organizations, new co-operatives, start-up companies, as well as multinational enterprises and state-owned companies (Cavicchi and Stancova, 2016).

Design thinking (DT) aims to solve complex problems (Razzouk and Shute, 2012) and promote innovation (Garbuio et al., 2018; Kurtmollaiev et al., 2018; Veflen and Gonera, 2023). The Minho region, renowned for its rich gastronomic heritage and viticulture, faces the dual challenge of preserving its traditions while adapting to contemporary demands for healthier and more sustainable food systems. This way, local food traditions play a central role, representing a valuable part of people's culture, firmly rooted in their memories (D'Andrea and D'Ulizia, 2023). Furthermore, in recent years, sustainability and health have gradually become relevant elements in consumer purchasing behavior (Sgroi et al., 2024), and regions that consider these factors in planning and promoting innovation strategies can gain a competitive advantage worldwide (Woodhill et al., 2022). In this context, the local actors (universities, SMEs, multi-national enterprises, research and technology organisations, science parks) are the key, fostering the sharing of knowledge and promoting

the innovation ecosystem (Guzman et al, 2024). This knowledge is made up of experience, attitudes, values, skills, contextual information and specialised vision (Gardeazabal et al, 2023). Innovation and knowledge-creation across agro-food related sectors and food value chains became a necessity for regional stakeholders that search for new production and business opportunities (Tartaruga, Sperotto and Carvalho, 2024).

The aim of this study is to present Design Thinking (DT) as a strategic approach to address the challenges in the Minho region, fostering the connection between tradition and innovation in food sustainability. By applying DT to food innovation, the study seeks to harness the collective creativity and knowledge of diverse stakeholders—such as chefs, producers, researchers, and consumers—to co-create innovative solutions that are deeply rooted in the region's cultural and environmental context.

After the introduction, Section 2 reviews the role of DT in the innovation process. Section 3 introduces the methodology. Section 4 provides a detailed analysis of the implementation of DT, and Section 5 summarises the conclusions and contributions.

2. BACKGROUND

2.1. Design Thinking: a Human-Centred approach to achieve food innovation

Design Thinking, a human-centered approach, emphasizes creativity, empathy, and iterative learning to tackle complex problems (Foster, 2021) and find solutions based on understanding human values, needs, emotions, and desires (Massari, 2017). DT is a human-centered approach to innovation that focuses on users and other stakeholders and employs iteration to address complex issues and create new products, services, and processes (Helman, 2023; Nordli and Gesierich, 2023). The DT process uses discovery, interpretation, and ideation processes to explore or widen a problem space; then, rapid prototyping, experimentation, and feedback cycles are used to refine and evolve ideas and narrow the problem space (Doorley et al., 2018). DT is important to promote innovation, generate ideas, and develop solutions in the innovation process (Kurek et al., 2023). The concept has emerged in sustainability literature to highlight food innovation (Olsen, 2015), the sustainable transition of businesses (Burke, Zhang and Wang 2023), and on sustainable business models innovation (e.g., Kurek et al, 2023), to achieve positive environmental, economic and social impacts (Mignon and Bankel, 2023).

Recently, quantitative studies have been carried out on the effect of the implementation of design thinking for innovation and have found positive effects (Gerken et al., 2022; Nakata and Hwang, 2020; Meinel et al., 2020; Nagaraj et al., 2020; Roth, Rau and Meyer, 2020; Robbins & Fu, 2022). Some scholars focus on issues related to research and development in the food industry, including innovation and commercialization of local food products (Yildiz, 2020), while others explore linkages between food and social innovation (de Souza et al, 2023), social inclusion (Michel-Villarreal, 2023; Trettvik, 2023) and sustainability (Michel-Villarreal, 2023). Additionally, some focus on the issues of place branding linked to culinary resources (Soonsan and Somkai, 2023).

3. CONCEPTUAL FRAMEWORK

The conceptual framework of this study is grounded in the principles of Design Thinking (DT), which encompasses a series of iterative and adaptive phases: Immersion, Definition of Needs, Ideation, Prototyping, Testing, Refinement, and Implementation. This structured yet flexible approach offers an effective methodology for addressing the complexities of food systems in the Minho region. It acknowledges the interconnectedness of local traditions, environmental sustainability, and public health, proposing a holistic model of innovation that respects and incorporates the region's unique enogastronomic identity.

The study also incorporates insights from recent quantitative research, which highlights the effectiveness of DT in fostering innovation. Evidence suggests that the Design Thinking methodology can substantially contribute to the development of creative, practical, and sustainable food solutions. By applying this approach, we aim to unlock new possibilities for food innovation that are both innovative and deeply aligned with the local context.

In adopting a multi-actor approach, the study emphasizes the importance of involving a diverse array of stakeholders—such as chefs, producers, researchers, and consumers—throughout the design process. This inclusion ensures that a wide range of perspectives and expertise are integrated, fostering a comprehensive and inclusive dialogue about the future of Minho's eco-gastronomy. Such collaboration is essential to co-create solutions that reflect both the region's cultural richness and its environmental priorities.

Ultimately, this study posits that food innovation can serve as a powerful lever for sustainable development, contributing to the economic growth of local communities, supporting environmental stewardship, and promoting health and well-being. By embedding these principles into the heart of Minho's food systems, we aim to develop a framework for food sustainability that is both innovative and contextually relevant to the region's unique socio-cultural and environmental landscape.

4. METHODOLOGY

4.1. Case description

The Minho Region is located in the north of Portugal (NUT II), bordering Galicia to the north and the Atlantic Ocean to the west. It is divided into three sub-regions (NUT III): Alto Minho, Cávado, and Ave. The region comprises 24 municipalities, which are split between the districts of Viana do Castelo and Braga;

Cávado: Esposende, Barcelos, Braga, Vila Verde, Amares, Terras do Bouro

Ave: Fafe, Guimarães, Póvoa de Lanhoso, Vieira do Minho, Cabeceiras de Basto, Celorico de Basto, Vila Nova de Famalicão, Vizela

Alto Minho: Arcos de Valdevez, Caminha, Melgaço, Monção, Paredes de Coura, Ponte da Barca, Ponte do Lima, Valença, Viana do Castelo, Vila Nova de Cerveira

The Minho region, with its diverse landscape ranging from coastal areas to mountainous terrains, offers a unique setting for exploring the intersection of gastronomy, culture, and sustainability.

Agriculture in the Minho is neither competitive nor specialized, being a subsistence family farming. The most common crops are maize, Vinho Verde, potatoes, vegetables, and fruit orchards. In addition, the region is recognized for its livestock farming, particularly cattle and poultry. The region's agricultural output is complemented by the growing sectors of tourism, crafts, and industry.

While the Minho region is blessed with fertile agricultural land, it also faces several environmental and sustainability challenges. Minho is experiencing the effects of climate change, including irregular rainfall patterns and rising temperatures, which impact traditional agricultural practices. Addressing water scarcity, soil erosion, and biodiversity loss has become crucial to ensuring sustainable farming practices. Intensive farming methods in some areas, alongside the dominance of monoculture farming (e.g., vineyards), have contributed to a reduction in biodiversity. Also, the region is facing challenges related to an aging farming population, as younger generations increasingly migrate to urban centers in search of better opportunities. This has led to concerns about the future of family-run farms and maintaining traditional agricultural knowledge.

Despite these challenges, the Minho region presents numerous opportunities to promote food sustainability and innovation: the region has the potential to embrace sustainable farming practices; Minho can explore circular economy models that promote food waste reduction, resource reuse, and the creation of local food networks that connect producers, consumers, and the hospitality sector; the Minho region has the opportunity to promote sustainable food tourism by highlighting local products, traditional dishes, and environmentally friendly agricultural practices. This could boost both local economies and environmental sustainability. The region can integrate digital technologies into its agricultural practices, including precision farming, online platforms for direct-to-consumer sales, and food traceability systems, which can enhance sustainability and market access for small-scale producers.

Through integrated approaches, such as Design Thinking, collaborative innovation, and sustainable agriculture, Minho can build a robust food system that supports both environmental stewardship and the health of its communities.

4.2. Process design

This study employs a Design Thinking methodology to develop sustainable food solutions in the Minho region. This approach is iterative, human-centered, and involves multiple stakeholders to

ensure practical and innovative outcomes. A purposive sampling strategy was used to select 12 participants, ensuring a diverse range of insights into food sustainability challenges. The invitation was sent by email. The workshop took place on 25th September 2023 in Caminha, at the Incubadora Verde de Agrela. Data was collected through a combination of 12 semi-structured interviews held in four municipalities of Alto Minho (Ponte de Lima, Arcos de Valdevez, Valença and Caminha) on 13th and 14th September 2023 with farmers, the mayor of each municipality, participant observations at one farmers' market in Caminha, and through the content analysis of various documents produced throughout the workshops held on 25th in Caminha. All participants signed an informed consent form before participating in the study. Confidentiality was maintained by anonymizing responses, and ethical approval was obtained from the Ethics Committee for the Social Sciences of the Polytechnic Institute of Viana do Castelo (IPVC).

The methodology employed in this study involves a series of workshops structured around the seven phases of the Design Thinking process. Each phase is designed to progressively refine ideas and solutions through collaborative efforts among stakeholders. The process (Figure 1) began with an Immersion phase, where participants were introduced to the context and challenges of Minho's food system. This step involves fully understanding and experiencing the problem or challenge that is being addressed. This often requires spending time in the environment where the problem exists, talking to and observing the people affected by it, and empathizing with their experiences. During the immersion phase, we gather as much information as possible through interviews, observations, and research. For this purpose we use tools such as empathy maps and journey maps to map out the user experience and identify pain points. By immersing oneself in the problem, we are able to gain a deeper understanding of the root causes and come up with more innovative and effective solutions. This immersive approach helps designers to see the problem from different perspectives and identify opportunities for improvement that may not have been obvious at first glance. In the second step – Definition of needs – refer to the specific problems or challenges that users are facing and the solutions they are seeking in order to address those issues. Identifying and understanding user needs is the first step in the design thinking process (Brown, 2008), as it allows designers to create innovative and effective solutions that meet the users' requirements and expectations. By focusing on users' needs, we can ensure that their products or services are relevant, user-friendly, and valuable for the target audience.

The objective of the ideation stage, the third step, is to generate a variety of creative ideas that have the potential to solve a particular problem or meet a specific need. At this stage the researcher conducts brainstorming sessions with multi-actor groups to generate creative solutions, apply design tools such as mind mapping, and "How Might We?" questions. Prioritize ideas using the impact-feasibility matrix, selecting solutions that balance sustainability, innovation, and practicality. Finally develop initial solution concepts for food system innovation.

Prototyping (fourth step) in the design thinking process involves creating a physical or digital model of the solution we have ideated during the ideation phase. The prototyping phase is crucial in order to test and refine the ideas before moving on to the final implementation stage. Transform ideas into tangible prototypes, such as new food products, local market platforms, or sustainable farming techniques. Create mock-ups, models, or digital prototypes to visualize and refine the solutions.

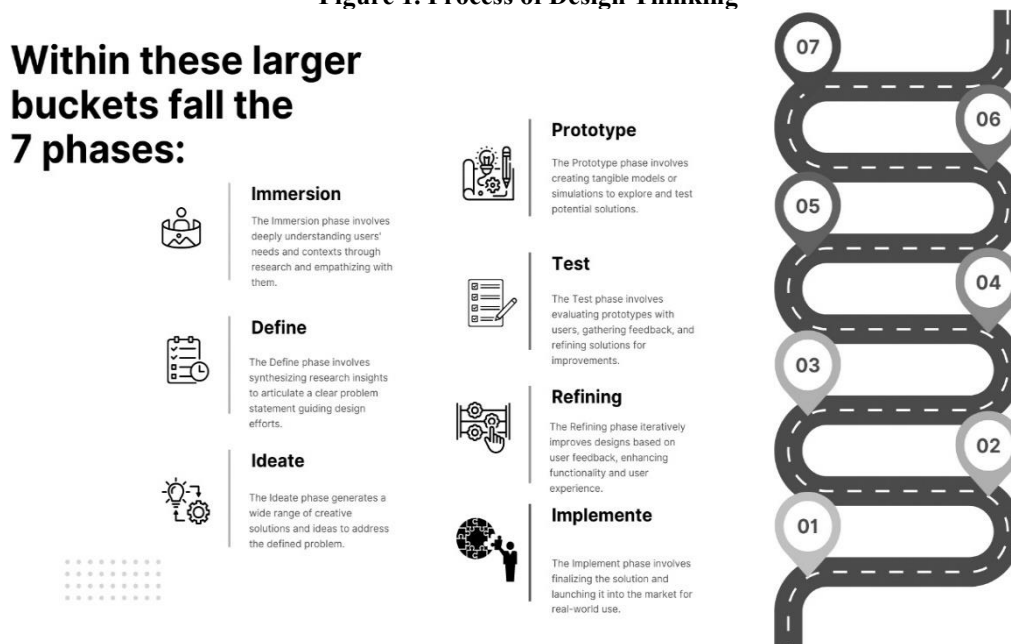
At the fifth step, the main objective is testing and collect feedback from participants involved in the pilot projects. We can use surveys, interviews, and observational studies to assess the effectiveness and acceptance of the proposed solutions. Identify barriers to implementation and make necessary adjustments based on feedback. Iterate and refine the prototypes before wider implementation is the sixth step. Finally, the seventh step, the implementation of pilot projects in real-world settings, involving farmers, restaurants, and consumers in testing new approaches.

This hands-on approach allowed for the testing of solutions in real-world settings, providing valuable feedback for refinement and eventual implementation.

Participants in the workshops represented a broad spectrum of expertise and perspectives, including natural and social sciences, design and arts, academia, industry, and government. This diversity was instrumental in fostering innovative ideas and ensuring that the solutions developed were both feasible and aligned with the region's needs and aspirations.

By employing Design Thinking as a methodological framework, this study seeks to offer actionable insights and practical solutions to enhance the sustainability of Minho's enogastronomy, contributing to the broader discourse on food innovation and sustainability.

Figure 1. Process of Design Thinking



Source: Own elaboration

4.3. Participants

4.3.1. Sample characterization

The sample comprises 12 participants, such as two kitchen chiefs, two consultants, two food producers, one journalist, one gastronomic historian, two researchers, and two policymakers. Out of the 12 participants that completed the whole activity, 33% were from natural sciences, 50% from social sciences, and 17% from design and arts. 17% were from academia, 33% from private companies, 17% from public companies and 33% from Civil Society or government. The mean age was 45 years (both calculated by using category midpoints).

5. RESULTS

Using the Design Thinking methodology, an innovative and collaborative approach was sought to reconcile gastronomic traditions with health and sustainability, thus guaranteeing a dialogue and a comprehensive solution that respected and promoted the territory.

Results of the immersion phase indicate that the Minho region possesses a rich gastronomic heritage deeply rooted in tradition, yet faces significant challenges in adapting to modern sustainability practices. Key findings from this phase highlight the importance of balancing historical food production methods with innovative solutions to reduce waste, enhance efficiency, and improve market accessibility. The brainstorming with participants revealed a strong commitment to preserving local food culture while recognizing the need for modernization. Also, they expressed concerns over the economic viability of traditional practices, while other participants demonstrated increasing interest in sustainable and locally sourced products. Policy analysis further indicated gaps in regulatory support for integrating sustainability-driven innovations. Several pain points emerged, including difficulties in adopting sustainable agricultural techniques, limited technological infrastructure, and the need for enhanced collaboration among key players in the food supply chain. Opportunities for innovation were identified in areas such as circular economy models, digital platforms for producer-consumer engagement, and education programs to promote sustainable consumption habits.

Definition of needs

In this step we analyze the collected data to identify key pain points in food production, distribution, and consumption.

The main goal was engage stakeholders in co-creation to define the most pressing challenges and sustainability goals, develop personas and stakeholder journey maps to visualize different

perspectives within the food system and formulate a clear problem statement that guides the ideation phase.

We've listed the main problems that have arisen:

- A small farmer who struggles with access to sustainable farming techniques and financial resources.
- A local distributor facing inefficiencies in supply chain logistics and waste management.
- A consumer looking for more transparent and sustainable food options, but who lacks information and accessibility.

Ideation stage: Generation of ideas

The aim of this study is to present Design Thinking (DT) as a strategic approach to address the challenges in the Minho region, fostering the connection between tradition and innovation in food sustainability. For this purpose, this stage starts with a question: How we can change the enogastronomy of Minho region? We start with a brainstormed, thought outside the box, and explored different perspectives to come up with innovative solutions (see Figure 2). The goal was to create diverse ideas that could be evaluated and refined in the following stages of the design process.

Each team then generated a series of ideas that could solve the problems of enogastronomy in the Minho region. This synthesis stage made it possible to build a connection between the various team members. At this stage, four key themes were identified: i) local and seasonal production, ii) short supply chains, iii) sustainability and tradition, and iv) valorization of local agents. This information allowed the team to explore these four dimensions.

Several collaborative tools were used to enhance the difference, such as the Challenge Mind Map (figure 3), the Stakeholder Map (figure 4), and the user vs planet (figure 5).

The Challenge Mind Map made it possible to organize thoughts, promote brainstorming and facilitate strategic planning. The Stakeholder Map visually represents the various individuals and groups involved (or potentially involved), providing an overview of the shared or opposing interests of the different "actors" and allowing you to predict future problems. The user x planet map, based on the Customer/Service Journey Map, visually represents a user's experience in the relationship with a service or product and its impact on the planet. Here, each "moment" of the life cycle of the service/product analyzed has a consequence on emotions and the earth.

Figure 2: Example of illustrations from brainstorming (diversity of ideas generated).



Figure 3: Example of techniques used: Stakeholder map



Figure 4: Example of techniques used: user vs planet

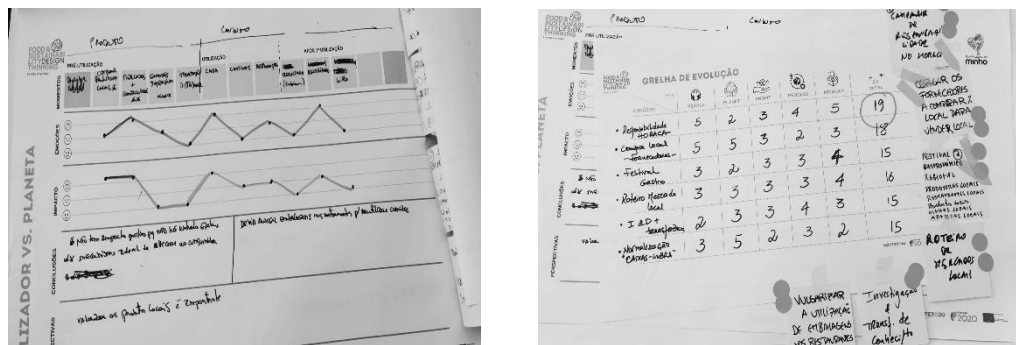


Figure 5: Example of generating ideas

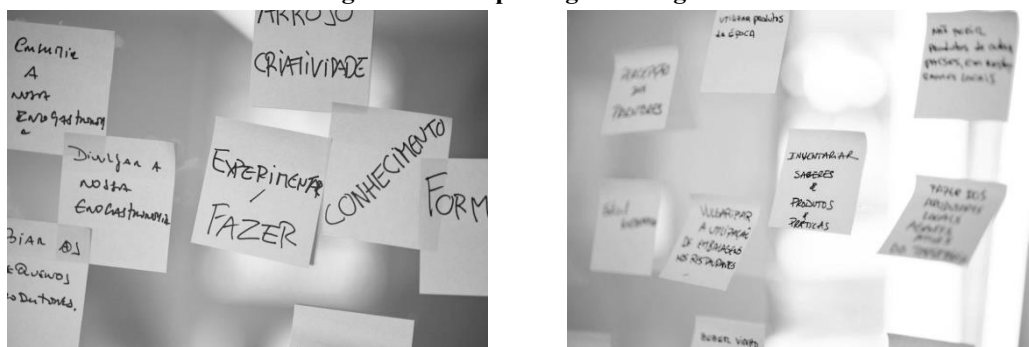


Figure 6: Example of convergence to a single solution



Prototyping the solution

Prototyping in the design thinking process involves creating a physical or digital model of the solution we have ideated during the ideation phase. The prototyping phase is crucial in order to test and refine the ideas before moving on to the final implementation stage.

This work resulted in several joint and integrated solutions for the gastronomic and wine scene in the Minho region, of which the following stand out:

Table 2- Integrated solutions for the gastronomic and wine scene in the Minho region

Thematic Approaches	Solutions
Local and Seasonal Production	Encouraging and valorising products from the region, respecting natural cycles and seasonality.
Short Food Supply Chains	Developing and encouraging supply networks that minimise the distance between producers and consumers, helping to reduce the carbon footprint.
Sustainability and Tradition	Balancing sustainable practices with the maintenance and promotion of local gastronomic and wine traditions
Valuing Local Agents	Emphasising the key role of farmers, livestock breeders and other agents who, through agro-ecological and sustainable practices, contribute to the vitality and authenticity of the territory.

Source: Own elaboration

Additionally, we have identified some key public policy approaches, which we present below.

Table 3- Key Public Policies

Thematic Approaches	Key Public Policies
Local and Seasonal Production	Subsidies & Grants: Financial incentives for farmers who focus on seasonal and local produce. Urban & Peri-Urban Agriculture: Supporting local food production in cities and nearby areas. Educational Campaigns: Encouraging consumers to buy seasonal products through awareness programs. Regulatory Support: Labeling laws that highlight local and seasonal products
Short Food Supply Chains	Direct Sales & Farmers' Markets: Support for farmers' markets, farm-to-table initiatives, and direct sales platforms. Public Procurement: Prioritizing local products in schools. Cooperatives & Collectives: Supporting farmers' cooperatives to improve access to markets. Digitalization: Encouraging online platforms that connect producers with consumers.
Sustainability and Tradition	Agroecology & Regenerative Practices: Policies that promote sustainable farming techniques. Food Waste Reduction: Encouraging better storage, redistribution, and local food processing. Protection of Traditional Practices: Recognizing and certifying traditional farming and food preparation methods.
Valuing Local Agents	Small-Scale Farmer Support: Fair pricing mechanisms, and training. Community Involvement: Participatory policymaking involving local farmers and food producers. Fair Trade & Ethical Sourcing: Certification and policies ensuring fair compensation for local producers.

Source: Own elaboration

Testing the solution

From the generation of innovative ideas to the creation of prototypes and concrete action plans, the experience culminated in the presentation of the results to a panel of local stakeholders, who provided guidance on the implementation of the proposals.

Implement the solution

To ensure the successful implementation and long-term sustainability of innovative solutions in the Minho region, it is essential to develop a comprehensive action plan for scaling effective initiatives. This plan should outline clear strategies for expanding successful solutions, adapting them to different contexts, and ensuring their long-term viability.

A critical step in this process is to engage local government bodies, organizations, and investors who can provide the necessary support, funding, and policy frameworks to facilitate implementation. Establishing partnerships with key stakeholders will help integrate these solutions into regional development strategies and enhance their impact.

Additionally, it is crucial to monitor and measure the long-term impact of these initiatives on food sustainability. This can be achieved through the use of key performance indicators (KPIs) that assess factors such as resource efficiency, environmental benefits, economic viability, and community well-being. Regular evaluation and feedback mechanisms will help refine the solutions and ensure their effectiveness over time.

Finally, fostering a continuous innovation ecosystem is essential for maintaining momentum and encouraging further collaboration among stakeholders. By promoting knowledge exchange, capacity building, and co-creation, this ecosystem will support ongoing improvements and adaptations, ensuring that food sustainability in the Minho region continues to evolve and thrive.

6. THEORETICAL AND PRACTICAL IMPLICATION

Through the multidisciplinary of the stakeholders, the workshops seem to be helpful in creating a suitable environment for knowledge sharing and to improve innovative solutions. Our findings have some theoretical and practical implications.

One of the primary benefits of prioritizing local and seasonal production is its significant environmental impact. By sourcing food locally, farmers minimize the emissions associated with long-distance transportation. Additionally, consuming in-season produce decreases reliance on energy-intensive greenhouse farming, promoting biodiversity and ecological balance. Another key advantage is the superior freshness and nutritional quality of locally grown food. Harvested at peak ripeness and swiftly delivered, these products retain more flavor and nutrients compared to those transported over vast distances. Furthermore, supporting local farmers strengthens the economy and fosters a sense of community, reinforcing regional sustainability and resilience.

Short food supply chains further enhance sustainability by establishing direct links between producers and consumers. With shorter transit times and minimal storage requirements, food arrives fresher and in better condition. These direct transactions also contribute to local economic stability, allowing small-scale farmers to thrive. Consumers benefit from greater transparency regarding the origin and production methods of their food, fostering trust and informed decision-making. Additionally, reducing dependency on long-haul transportation lowers the carbon footprint, making these supply chains an environmentally responsible choice.

Integrating sustainability with the preservation of local culinary and viticultural traditions requires strategic planning. Choosing sustainably produced, seasonal ingredients not only supports farmers but also ensures high-quality, fresh dishes. In the wine industry, prioritizing wineries committed to organic, biodynamic, and resource-efficient practices helps safeguard both the environment and regional heritage. Celebrating traditional recipes and cooking techniques is equally important, as these dishes embody cultural identity and historical continuity. Restaurants that embrace both sustainability and tradition create authentic and meaningful dining experiences that respect both nature and heritage.

Recognizing the essential role of farmers, livestock breeders, and other stakeholders in maintaining agroecological practices is crucial for sustaining local food systems and preserving biodiversity. Through methods such as crop rotation, integrated pest management, and organic farming, these individuals cultivate nutritious food while minimizing environmental impact. Their commitment to traditional and sustainable practices ensures the longevity of regional agricultural heritage. Supporting these efforts requires a collective approach involving consumers, policymakers, and businesses, all of whom can contribute by prioritizing locally sourced, eco-friendly products.

Territorial policymakers should consider the design thinking mindset when developing strategies for addressing territorial issues. DT is a problem-solving approach that prioritizes human-centered design, iteration, collaboration, and empathy. By engaging in a design thinking process, policymakers can better understand the needs and perspectives of all stakeholders involved in territorial issues, leading to more effective and sustainable solutions. DT can act as a catalyst for innovation in the conception of ideas and subsequent implementation in the territory. By incorporating design thinking into their policymaking processes, territorial policymakers can create more inclusive, user-friendly, and responsive policies that address the complex and interconnected challenges facing their communities. Additionally, the iterative nature of design thinking allows policymakers to continuously improve and adapt their strategies based on feedback and data, leading to more effective and successful outcomes. Overall, the design thinking mindset and toolkit can empower territorial policymakers to think creatively, act empathetically, and engage collaboratively in addressing territorial issues, ultimately leading to more holistic and sustainable solutions for their communities and region.

7. CONCLUSIONS, LIMITATIONS, AND FUTURE DIRECTIONS

To explore the future of Minho enogastronomy, several stakeholders discuss and find common solutions that represent a bridge between tradition and innovation, a call to action for preserving and valorizing Minho's gastronomic and wine wealth. The participants emphasized that it is not only feasible but also essential to look at the future of Minho enogastronomy with a sustainable and conscious eye, one that respects both the legacy of past generations and the needs of future ones. The results reflect how to maximise and adapt these riches in an ever-changing global scenario. Regional stakeholders, producers, government officials, chefs, and consumers must play their part in building a more sustainable, innovative, and, above all, authentic gastronomic Minho. By using a multi-actor approach, we can create more inclusive, impactful, and sustainable solutions that address all stakeholders' diverse needs and perspectives. This collaborative approach can lead to better outcomes, increased buy-in, and stronger relationships with your stakeholders. There is a collective responsibility to ensure that Minho's cultural and gastronomic legacy remains inactive time but evolves in a responsible and integrated manner. In order to give continuity and realize the ideas and solutions presented, we recommend the establishment of strategic partnerships between producers, government, and other stakeholders; development of programs to support and encourage sustainable agricultural and production practices; training and awareness-raising actions among sector players and the community in general about the importance and advantages of a sustainable and healthy food ecosystem; events and initiatives that promote the region's enogastronomy, valorizing its products and traditions while incorporating innovative and sustainable practices and solutions. Also, place branding is a crucial strategy to be carefully planned and monitored by both national and regional governments, as educational activities related to sustainability, nutrition, food preparation, and hospitality are needed to sustain effective development paths and facilitate community empowerment.

The study has some limitations due to the small sample size of target groups involved in the participatory activities, which is not representative of a population for statistical analysis.

Further studies must consider strengthening the relationships and cooperation among local communities, local authorities, local associations, and educational institutions, to ensure that everyone understands the objectives and commitments required to maintain Minho's cultural and gastronomic legacy and ensure its long-term sustainability.

REFERENCES

Batat, W. (2021), "From Design Thinking (DT) to Experiential Design Thinking (EDT): New Tool to Rethink Food Innovation for Consumer Well-Being. Design Thinking for Food Well-Being", *The Art of Designing Innovative Food Experiences*, pp. 3-18. https://doi.org/10.1007/978-3-030-54296-2_1

Burke, H., Zhang, A., Wang, J. X. (2023), “Integrating product design and supply chain management for a circular economy”, *Production Planning & Control*, Vol. 34, nº 11, pp. 1097-1113. <https://doi.org/10.1080/09537287.2021.1983063>

Cavicchi, A., K., Ciampi Stancova, (2016); “Food and gastronomy as elements of regional innovation strategies. European Commission, Joint Research Centre, Institute for Prospective Technological Studies, Spain. EUR 27757 EN; <https://dx.doi.org/10.2791/284013>

D’Andrea, A., D’Ulizia, A. (2023), “Preserving Local Food Traditions: A Hybrid Participatory Approach for Stimulating Transgenerational Dialogue”, *Societies*, Vol. 13, nº 4, pp. 95. <https://doi.org/10.3390/soc13040095>

de Souza, J. C., da Silva Pugas, A., Rover, O. J., Nodari, E. S. (2023), “Social innovation networks and agrifood citizenship. The case of Florianópolis Area, Santa Catarina/Brazil”, *Journal of Rural Studies*, Vol. 1, nº 99, pp. 223-232. <https://doi.org/10.1016/j.jrurstud.2021.09.002>

Doorley, S., Holcomb, S., Klebahn, P., Segovia, K., Utley, J. (2018). Hasso Plattner Institute of Design at Stanford. Design thinking bootleg.

Foster, M. K. (2021), “Design thinking: A creative approach to problem solving”, *Management Teaching Review*, Vol. 6, nº2, pp. 123-140. <https://doi.org/10.1177/2379298119871468>

Garbuio, M., Dong, A., Lin, N., Tschang, T., Lovallo, D. (2018), “Demystifying the genius of entrepreneurship: How design cognition can help create the next generation of entrepreneurs”, *Academy of Management Learning & Education*, Vol. 17, nº 1. <https://doi.org/10.5465/amle.2016.0040>

Gardeazabal, A., Lunt, T., Jahn, M. M., Verhulst, N., Hellin, J., Govaerts, B. (2023), “Knowledge management for innovation in agri-food systems: a conceptual framework”, *Knowledge management research & practice*, Vol. 21, nº 2, pp. 303-315. <https://doi.org/10.1080/14778238.2021.1884010>

Gerken, S., Uebernickel, F., De Paula, D. (2022). *Design thinking: a global study on implementation practices in organizations: Past-present-future*. Universitätsverlag Potsdam.

Guzman, J., Murray, F., Stern, S., Williams, H. (2024), “Accelerating Innovation Ecosystems: The Promise and Challenges of Regional Innovation Engines”, *Entrepreneurship and Innovation Policy and the Economy*, Vol. 3, nº1, pp. 9-75.

Helman, J. (2023), “The Role of Design Thinking in Fostering Innovation for Industry 4.0. In *International Conference on Intelligent Systems in Production Engineering and Maintenance*. Cham: Springer Nature Switzerland, , pp. 589-599.

Kurek, J., Brandli, L. L., Leite Frandoloso, M. A., Lange Salvia, A., Mazutti, J. (2023), “Sustainable Business Models Innovation and Design Thinking: A Bibliometric Analysis and Systematic Review of Literature”, *Sustainability*, Vol. 15, nº 2, pp. 988. <https://doi.org/10.3390/su15020988>

Kurtmollaiev, S., Pedersen, P. E., Fjuk, A., Kvale, K. (2018), “Developing managerial dynamic capabilities: A quasi-experimental field study of the effects of design thinking training”, *Academy of Management Learning & Education*, Nº17, 184-202. <https://doi.org/10.5465/amle.2016.0187>

Massari, S. (2017), “Food design and food studies: Discussing creative and critical thinking in food system education and research”, *International Journal of Food Design*, Vol. 2, nº1, pp. 117-133. https://doi.org/10.1386/ijfd.2.1.117_1

Meinel, M., Eismann, T. T., Baccarella, C. V., Fixson, S. K., Voigt, K. I. (2020). “Does applying design thinking result in better new product concepts than a traditional innovation approach? An experimental comparison study”. *European Management Journal*, Vol. 38, nº 4, pp. 661-671. <https://doi.org/10.1016/j.emj.2020.02.002>

Michel-Villarreal, R. (2023), “Towards sustainable and resilient short food supply chains: a focus on sustainability practices and resilience capabilities using case study”, *British Food Journal*, Vol. 125, nº5, pp. 1914-1935. <https://doi.org/10.1108/BFJ-09-2021-1060>

Mignon, I., Bankel, A. (2023). “Sustainable business models and innovation strategies to realize them: A review of 87 empirical cases”. *Business Strategy and the Environment*, vol. 32, nº 4, pp. 1357-1372. <https://doi.org/10.1002/bse.3192>

Nagaraj, V., Berente, N., Lyytinen, K., Gaskin, J. (2020). Team design thinking, product innovativeness, and the moderating role of problem unfamiliarity. *Journal of Product innovation management*, Vol. 37, nº4, pp. 297-323. <https://doi.org/10.1111/jpim.12528>

Nakata, C., Hwang, J. (2020). “Design thinking for innovation: Composition, consequence, and contingency”. *Journal of business research*, Vol. 118, pp. 117-128. <https://doi.org/10.1016/j.jbusres.2020.06.038>

Nordli, A. J., Gesierich, S. (2023). Measuring the use of design thinking and co-creation for innovation. In *Handbook of Innovation Indicators and Measurement* (pp. 342-362). Edward Elgar Publishing. <https://doi.org/10.4337/9781800883024.00029>

Olsen, N. V. (2015), "Design thinking and food innovation", *Trends in food science & technology*, Vol. 41, n°2, pp. 182-187. <https://doi.org/10.1016/j.tifs.2014.10.001>

Razzouk, R., Shute, V. (2012), "What is design thinking and why is it important? Review of Educational Research, n° 82, pp. 330-348. <https://doi.org/10.3102/0034654312457429>

Hannah Ritchie, Pablo Rosado and Max Roser (2022) - "Environmental Impacts of Food Production" Published online at OurWorldinData.org. Retrieved from: '<https://ourworldindata.org/environmental-impacts-of-food>' [Online Resource]

Robbins, P., Fu, N. (2022). "Blind faith or hard evidence? Exploring the indirect performance impact of design thinking practices in R&D". *R&D Management*, Vol. 52, n° 4, pp. 704-719. <https://doi.org/10.1111/radm.12515>

Roth, K., Globocnik, D., Rau, C., Neyer, A. K. (2020). "Living up to the expectations: The effect of design thinking on project success". *Creativity and innovation management*, Vol. 29, n° 4, pp. 667-684. <https://doi.org/10.1111/caim.12408>

Sgroi, F., Sciortino, C., Giamporcaro, G., Modica, F. (2024), "Exploring the impact of beliefs and experiential factors on extra virgin olive oil consumption", *Journal of Agriculture and Food Research*, Vol. 15 pp. 101056. <https://doi.org/10.1016/j.jafr.2024.101056>

Sijtsema, S. J., Fogliano, V., Hageman, M. (2020), "Tool to support citizen participation and multidisciplinary in food innovation: circular food design", *Frontiers in sustainable food systems*, Vol. 4, pp. 582193. <https://doi.org/10.3389/fsufs.2020.582193>

Soonsan, N., Somkai, U. (2023), "Dimensions of gastronomic experience affecting on sharing experience: place attachment as a mediator and length of stay as a moderator", *Journal of Hospitality and Tourism Insights*, Vol. 6, n°1, pp. 344-361. <https://doi.org/10.1108/JHTI-07-2021-0171>

Tartaruga, I., Sperotto, F., Carvalho, L. (2024), "Addressing inclusion, innovation, and sustainability challenges through the lens of economic geography: Introducing the hierarchical regional innovation system", *Geography and Sustainability*, Vol. 5, n°1, pp. 1-12. <https://doi.org/10.1016/j.geosus.2023.10.002>

Trettvik, M. (2023), "How a resource center for urban agriculture can provide multidimensional tools for social inclusion. The case study of Godsen, Drammen (Master's thesis, Norwegian University of Life Sciences). <https://hdl.handle.net/11250/3097640>

Veflen, N., Gonera, A. (2023), "Perceived usefulness of design thinking activities for transforming research to impact. *Food Control*, n° 143, pp. 109264. <https://doi.org/10.1016/j.foodcont.2022.109264>

Woodhill, J., Kishore, A., Njuki, J., Jones, K., Hasnain, S. (2022), "Food systems and rural well-being: challenges and opportunities", *Food Security*, Vol.14, n°5, pp. 1099-1121. <https://doi.org/10.1007/s12571-021-01217-0>

Yildiz, I. (2020), "Innovation and commercialisation dynamics in agri-food industry under contemporary forcing functions", *International Journal of Research, Innovation and Commercialisation*, Vol. 3, n°1, pp. 1-21. <https://doi.org/10.1504/IJRIC.2020.109372>