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Oral Presentations

Uncovering local perspectives on sustainability in Ecuadorian cocoa farming communities through Photovoice action research

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To improve the sustainability of farm systems and ensure effective interventions, it is crucial to adopt a community-driven and culturally sensitive approach, as local perspectives and priorities may not align with standard definitions of sustainability. This study aims to identify from the bottom-up what sustainability actually means for Ecuadorian cocoa farmer communities in 2 distinct social and geographical environments: the more intensified coastal region of Naranjal and the Amazonian region of Tena characterized by the chakra production system of Kichwa indigenous communities. To do this, the photovoice method was used to identify local sustainability criteria, their positive or negative development over the last 5 years, and influential actors. Photovoice uses participatory photography and written interpretations of the resulting images to structure focus group discussions around a topic chosen by the researcher (in this case, “sustainable livelihoods”) that is delivered through a “prompt”. This was conducted with groups of 21 and 22 participants, respectively, in the two regions. The material was used to evaluate the differences in how the social-ecological context influences the local definition of sustainability via emergent criteria between the distinct farming communities of both regions. Furthermore, differences among the participants of the same farming community were compared to identify how factors like gender influence the framing of sustainability challenges. Finally, co-created sustainability profiles were compared to existing expert-based or “top-down” sustainability frameworks (e.g. the SDGs, SAFA) to understand the complementary value of both local and scientific knowledge. The results give insights into how sustainability is conceptualized within farming communities and to what extent interventions or policies need to be tailored to the specific local and cultural context in order to be successfully adopted. The key strength of this study was the empowerment of participants by placing them in the role of the active investigator (i.e. in selecting topics of interest), while the researchers merely facilitated this process of knowledge co-creation.

Collaboration and resilience in the Scottish pig supply chain

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The pig industry in Scotland is relatively small when compared to the cattle and sheep ones. The most recent information available indicates that in 2020, the red meat sector (i.e., cattle, sheep, and pig) contributed £1.29 billion to the total agricultural output (i.e., 37 per cent), of which pig production was £139 million (4 per cent of the total agricultural output). Its production is destined to both the domestic market, where it competes with imports, and the international market (e.g., China). The Scottish pig supply chain has been exposed to many shocks, which have threatened its survival, such as processors bankruptcies, the COVID-19 pandemic effects, the UK exiting the European Union (Brexit), the Swine flu pandemic and the implications of the Russia-Ukraine conflict. Moreover, the pig sector has not benefited directly from government support (e.g., Single Farm Payment), which has made its situation even more challenging than other agricultural sectors and more dependent of devising its own tools to reduce its vulnerability and ensure its economic sustainability. The development of the Scottish pig supply chain and its reaction to shocks is interesting to study because, on the one hand, it has many features in common with other agri-food supply chains, particularly livestock ones, and on the other hand, it allows us to illustrate how, particularly horizontal collaboration (i.e., vertical collaboration is between two or more organizations from different stages in supply chain whilst horizontal is between organizations at the same stages), in the form of pig cooperatives have played a role in both: reducing the vulnerability of producers, i.e., increasing their resilience to several shocks, and on the process of value creation. Moreover, although the sector has sporadically established vertical collaboration arrangements, these have been more difficult to achieve. Therefore, the purpose of the paper is to illustrate the above points (i.e., tools and practices for reducing food systems' vulnerability) as well as the implications that changes in the economic environment e.g., changes in consumption patterns and in the retail sector, have had on the pig supply chain. The paper uses a business history approach, which combines the sector history (e.g., evolution of major events such as abattoirs bankruptcies), with the use of economic indicators constructed on several databases (e.g., food balance sheet for the sector; consumer trends of the sector major products, e.g., fresh pork, bacon, sausages; and output and input prices). The conclusions of the paper indicate that while horizontal collaboration has been successful on keeping the sector afloat, vertical collaboration, which would have helped the sector thriving has been more elusive due to a number of reasons (e.g., increasing competition for the created value added upstream the supply chain, between farmers and processor). However, there is the possibility that the requirements behind the UK net zero strategy by 2050, in particular, those related to Scope 3 (i.e., emissions from sources connected to a business, rather than being generated by your business directly) may provide another opportunity to generate vertical collaboration for the Scottish pig supply chain.

Exploring consumer preferences for quality labels on extra virgin olive oil: Accounting for stated versus inferred attribute non-attendance

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The significance of search, experience, and credence attributes in influencing consumers' acceptance and preferences for extra virgin olive oil (EVOO) has been extensively explored. However, empirically, only a limited body of literature has investigated consumers' willingness to pay (WTP) for more than one protected designation of origin (PDO) within the same region. Methodologically, only a few studies that use choice experiments in food economics have estimated attribute non-attendance (ANA), which helps offer results that are more closely aligned with reality. The objective of this research is to examine how consumers living in a Spanish region trade-off between two different local versus other PDOs and the European Union organic label. To address this objective, a choice experiment explored consumer utilities and their WTP for the selected EVOO attributes included in the study. Additionally, we advance methodologically, and measure stated versus inferred ANA for the different attributes. The results indicate that consumers were willing to pay higher prices for one liter of EVOO with the PDO and organic label than without them. The highest WTP was received by the local PDOs and the lowest by the organic label. ANA estimates suggest that indeed respondents ignored several attributes during the evaluation. Stated ANA performed better than the inferred ANA model. The most ignored attribute was the organic certification, followed by PDO and price, and 30% of the sample fully attended all the attributes from the choice experiment. These results show the importance of ANA in consumer behaviour, demonstrating that not accounting for ANA affects coefficient estimates and the WTP for the considered attributes. Our results can help EVOO producers feature important attributes to consumers and highlight consumers' preferences towards food products with quality certifications.

Sustainability of Indigenous Green Leafy Vegetable Value Chains in Uganda: Status Quo and Identification of Key Determinants

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Demand for vegetables in Uganda is projected to increase over six times by 2030, potentially necessitating adjustments in production, processing, distribution, and handling methods. These changes could lead to both positive and negative impacts on sustainable production and consumption. This study assessed the status quo sustainability of indigenous green leafy vegetable value chains and identified barriers to and facilitators of sustainably supplying vegetables in Uganda. A value chain analysis employed both purposefully and randomly selected actors. Sustainability was assessed through an indicator-based approach, constructing an index encompassing economic, environmental, and social factors. Findings indicated economic sustainability but revealed social and environmental unsustainability within the value chains. The value chains were found to be short, highly informal, economically sustainable, but socially and environmentally unsustainable. Barriers to sustainability include non-compliance with chemical quality standards by input suppliers due to a near-absent regulatory system, posing environmental challenges exacerbated by production in wetlands (40%) and high pesticide usage (70% of farmers). In addition, although generally profitable (15% margins) hence economically sustainable, most farmer plots are close to non-feasibility levels (less than 0.25 acres) and rely on rented land (57% verbal agreements). All hired labor is verbally contracted and temporary posing social sustainability challenges in addition to absence of farmer organization and consumer protection arrangements. This study suggests improving access to production land and implementing solutions for sustainable production in fragile ecosystems, such as wetlands. This can be achieved through integrating environmental education into farmer extension programs and promoting value addition, aiming to enhance economic, environmental, and social sustainability of the value chains that are significant sources of employment for youth and women in urban and peri-urban areas.

Uncovering power and biodiversity issues in agri-food value chains

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The nexus of power and biodiversity lies at the heart of value chain discourse, shaping our understanding on how value chains can contribute to mitigating climate change and addressing food security challenges. The proposed article addresses these issues through a specially developed methodological approach that combines Hilbert–Ackermann logic systems within hybrid Sankey-diagram-based analytical frameworks that uncover value chain structures, power elements, and potential biodiversity effects. It is a mixed methods approach where the strength in value chain interlinkages is explored through the utilization of a questionnaire that addresses dimensions of market alternatives, cooperation history, institutional barriers etc. while biodiversity issues are uncovered through in-depth interviews with experts and industry insiders. The analysis of value chain structures is further illustrated through a series of statistical visualizations and hybrid Sankey diagrams. The former include violin charts that combine elements of box plot and kernel density plots. The box plots account for interquartile ranges (IQR), medians, means, and min/max proxy scores, while the kernel density estimation (KDE) plots, also known as the Parzen–Rosenblatt window method, use kernel smoothing for probability density estimation. In all the examine cases the Epanechnikov kernel was applied, with an overridden “rule-of-thumb” bandwidth estimation against each examined category to help illustrate the differences in resolution. In addition, spider diagrams provide graphical representations to the uncovered power structures among the value chain interlinkages. Finally, hybrid Sankey-type diagrams provide a complete representation of each examined value chain, encapsulating overall strength dimensions and biodiversity causality paths. The analysis is applied in four European countries (namely France, Italy, Norway, and Germany), with a focus on three value chains within each country; thus, twelve value chains in total. The results provide invaluable insights in the structure of the examined value chains, especially when it comes to the strength of interlinkages among the value chain participants and the potential biodiversity issues and sets the methodological foundations for a new way in understanding value chains. The proposed article is a result of the BioValue project – “Fork-to-farm agent-based simulation tool augmenting BIOdiversity in the agri-food VALUE chain” that has received funding from the European Union’s Horizon 2020 research and innovation programme.

The effects of soil consumption and human diets on the degree of self-sufficiency in Austria

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In Austria, several agricultural commodities are produced. Despite a high degree of self-sufficiency, being above 100% for several commodities, domestic supply is not sufficient to feed the entire population. Moreover, current high rates of soil consumption and an ongoing population growth threaten food security. Therefore, the Austrian government has set the target to limit soil consumption to 2.5 ha per day by 2030. Our study aims to (i) determine the consequences of arable land loss on food security between 1999 and 2020 (PAST); and (ii) use scenario analyses for determining the effects of current soil consumption (REF) and achieving the 2.5-ha-target (S_2.5) on the degree of self-sufficiency by 2030. Moreover, we hypothesize that a reduction of animal products in human diets, as recommended by (inter-)national organizations (e.g., WHO, Austrian Nutrition Society), can be an important lever to increase food security. Therefore, we analyze the influence of changes in human diets in another scenario (S_DIET). In PAST, changes of arable land are determined using the Farm Structure Surveys 1999 and 2020 and evaluated at municipal level. To derive the potential crop yields, average yields per hectare for 2020 to 2022 are assumed. Moreover, the “Getreideeinheit” (GE; grain unit) is used to express how well a certain agricultural commodity is suited for human nutrition, summarizing all agricultural commodities into an aggregate value. First results of our analyses show that cultivated arable land in Austria has decreased by about 72,400 ha (5.2%) between 1999 and 2020. This corresponds to a decrease in agricultural production of about 1.9 mio. tons or 5.1 mio. tons GE. Assuming a demand of 10.4 GE per person and year (2020 observation), about 493,400 more people could be fed without arable land loss from 1999 to 2020. Our results underline the urgency of limiting soil consumption and the declined of agricultural land in Austria.

Digital Technologies and Climate Smart Agriculture - the Case of Variable Rate Fertilisation in Austria

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Among the expected benefits of a more common use of digital technologies is the reduction of environmental stress due to agriculture. Agricultural machinery equipped with digitised tools and controlled by specialised software helps farmers to use water, mineral fertilisers, insecticides, and herbicides more efficiently, as the quantities of applied substances can be better matched to site- and application-time-specific crop needs. This article focuses on mineral fertilisers, using Austrian winter wheat production as a case study to explore the potential benefits of variable rate application of fertiliser. To employ this new approach in crop production, a number of specialised tools and information systems must be combined and integrated into the agricultural production process. The new technology requires not only new equipment but also new skills. Farmers will only be willing to adopt them if the technical barriers are low. Based on experimental data on variable rate fertiliser application in Austria, we estimate the potential cost savings of fertilisers in wheat production. We explore the consequences for agricultural value added in a scenario of a nationwide adoption. In addition, we assess the environmental consequences. The results show that the benefits of variable rate fertiliser applications are cost savings, slightly higher yields on treated fields and lower nutrient surpluses that would impair groundwater and air quality.

Understanding Italian consumers' engagement with cultured meat. An insight on the role of political ideology and risk attitude.

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Cultured meat (CM) aims to provide an alternative source of protein that mimics famed meat (FM). However, the concept of CM is still relatively new, and how consumers view it would make a difference in its success. This study focused on the role of political ideology, risk perceptions and preferences in engagement with CM. We conducted a survey in December 2023 with 800 participants who are representative of the Italian population in terms of age, gender, and region of residence. The data was collected through the Ipsos digital platform. We used an ordered logistic regression. The results indicated that Italian consumers have a positive perception of CM, as nearly half of the respondents declared their willingness to try (WTT) CM. The results of the logistic regression suggested that being male, young, and highly educated increased willingness to engage with CM. As levels of commitment increase (i.e., willingness to eat, willingness to buy CM), behavioral intentions were mainly explained by familiarity and risk attitude. All dependent variables used to measure risk attitude (i.e., the risk of zoonosis of CM as compared to FM, risk attitude towards new food, and towards food in general) significantly predicted WTT. In terms of political ideology, being conservative decreased the likelihood of trying CM. Our results provide new insights, suggesting which factors to take into account to promote CM. FUNDING STATEMENT This paper has been financed by VITALITY PNRR project “Innovation, digitalisation and sustainability for the diffused economy in central Italy” (C43C22000380007).

Exploring the Market Potential for Tomato Cultivated from Local Landraces: A Segmentation Approach Using an Inferred Non-Attendance Choice Experiment

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This study investigates the market potential for vegetables cultivated from local landraces by examining consumer attitudes and their willingness to purchase and pay for these products through an online survey administered to vegetable consumers in Aragon. By employing a segmentation approach using an inferred non-attendance choice experiment, distinct consumer segments are identified based on their inferred non-attendance to the attributes of interest, price, and local variety. The choice experiment is applied to the most consumed vegetable in the region: tomato. Estimations from an Equally Constraint Latent Class (ECLC) model allow to infer the proportion of respondents considering or not different combinations of the attributes. Specifically, three consumer segments are identified: the largest segment (around 60% of the sample) considering both price and local variety in their choices, a medium-sized segment (around 25% of respondents) considering only the price but ignoring the local variety, and a smaller segment that ignores the price attending only the local variety. Therefore, the last segment consisted of consumers willing to purchase the vegetables from local landraces regardless of the price while the medium-sized segment did not care about the local variety considering only the price. Consumers in the largest segment may purchase vegetables from local landraces depending on the price and their estimated marginal willingness to pay for the local variety accounts for 3.11 €/kg. These three segments are profiled based on socio-demographics, importance given to different attributes when shopping vegetables, vegetables purchase and consumption behaviour, and the attitudes towards local landraces. In addition, the factors proposed by the Azjen's Theory of Planned Behaviour are also used (attitudes toward the purchase, the subjective norms, and the perceived behavioral control). This segmentation analysis provides valuable insights for local producers in developing effective targeted and tailored marketing strategies to different consumer segments, thus maximizing the market potential for vegetables cultivated from local landraces.

Stakeholders positions on greenhouse gas emissions mitigation from Germany's cattle supply chain

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Cattle milk and meat, from production to post-consumption, affect both local and global sustainability levels, including climate. Unilateral national climate actions risk unintended consequences due to, inter alia, a fragmented understanding of stakeholder behavior in climate mobilization. To ensure timely climate action, it is critical to review individual GHG-intensive supply chain stakeholders' mitigation roles while emphasizing national-specific responsibility. We contribute to the scientific debate on greenhouse gas (GHG) emissions mitigation from food systems by focusing on cattle in Germany and the perspectives of various stakeholders, including supply and demand sides, government, and academia. This contribution emerges from a systematic review of over 40 studies. We consolidate a snapshot of the cognition-action gap in pro-climate- cattle meat and milk consumption and stakeholders' preferences for cattle-related GHG mitigation policies in Germany. We find the widest gap between retailers and policymakers and the narrowest in public food services. Barriers to closing the gap include political inertia, weak regulations, ambiguous commitments, fears of sales decline, poor communication, and cognitive dissonance. Regarding policy preferences, German cattle producers prefer positive incentives/subsidies (81%) over direct restrictions (27%) to mitigate GHG emissions. Consumers support certain nudges (up to 64%) and bans on unhealthy food advertising (79%). Research gaps include the need for more objective indicators for mitigation campaigns and retailers' initiatives, real (not just stated) effects of labeling, threats to scientific integrity from industry-influenced conflicts of interest, and long-term studies on nudging and retailer initiatives. We recommend the following to bridge the cognition-action and policy preferences gaps: i. Mobilize tailored financial incentives throughout the supply chain, from downstream to upstream. ii. Balance policy priorities between the most affected and the most influential stakeholders. iii. Transparently communicate any conflicting scientific interests and whether reported policy assessed are net or partial effects, mono or multi-policy goal. iv. Consistently define, monitor and report policy progress from objectives to implementation. v. Ensure information targeting consumers includes not only product attributional but also region-consequential climate effects. Panel studies and encrypted-aided research can help address some of the identified research gaps.

Consumer attitudes towards visiting a wine destination

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Wine tourism is a form of alternative tourism that has attracted much attention in recent years. Nowadays, wine tourism is one of the most important and most promising types of tourism, given that it is linked to the new consumption patterns of tourists, based on the importance of the experience, as well as on a shorter duration and greater frequency in the number of visits. The aim of this research is to explore motives for visiting a wine destination. Objectives are to a) identify the critical factors in choosing a wine tourism destination, b) explore overall satisfaction of the destination, c) explore the loyalty of wine tourists, d) to segment the market and e) profile each segment. An online questionnaire was utilized in data collection employing criteria sampling method with a final sample of 266 wine tourists. The most important attributes rated high for choosing a wine tourism destination were that the ‘wine destination is famous for its wines’, ‘there is an adequate availability of information of the destination’, ‘wineries of the area’, and ‘the existing wineries welcome visitors’. The highest rated motives for visiting a wine destination were as according to the respondents ‘to be able to identify a high-quality wine’, ‘to taste local wines and associated local food’, and ‘to learn to purchase quality wines’. Tourists reported (on a 5-point Likert type scale) that they tend to be satisfied from the destination chosen (MV=3.82) and are likely to recommend wineries tour to other customers. Data analysis extracted two factors in choosing a wine tourism destination, and three factors were extracted for tourists’ motives. Cluster analysis extracted three distinctive groups of wine tourists, the ‘Popular destination orientated tourist’, the ‘Socializing orientated tourist’ and the ‘Don’t care but it was a good experience tourist’. These results can help wine tourism destination managers to plan and implement strategies in order to attract tourists and satisfy their specific needs for future destination loyalty.

Are farms in short food supply chains more resilient to external shocks? The empirical study from Poland.

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Agricultural systems face many challenges which raise a problem of capability to absorb shocks and stresses of internal and external nature. While some situations require a relatively small adjustments at farm level, many exogenous perturbations need significant and input-intensive transformations. Therefore, building and strengthening resilience is a key to survive in a time of crisis. The aim of the study is to indicate how resilient were Polish farms during the pandemic and post-pandemic period. Hence, our research question is: are farms involved in short food supply chains more resilient than those not involved? Our attention is focused on the comparison of farms participating and not participating in short food supply chains (SFSCs) systems. This approach serves to answer the question whether participation in 'short' sales increases the resilience of farms to external shocks (like COVID restrictions, energy crisis, high inflation, war in Ukraine). Our study is embedded in the resilience theory and framework with three resilience capacities: robustness, adaptability and transformability. In the analytical part, we employed the original questionnaire on economic, environmental and socio-demographic issues. A separate part of survey concerned personal perception of resilience in crisis condition and concentrated on subjective assessment of farm managers. We selected group of 200 small-scale farms in Poland with area up to 20 ha of UAA and standard output up to EUR 50 thousand. To determine the differences between farms of both groups we used Z-test and Kolmogorov-Smirnov test. The analysis reveals a relatively higher total resilience of farms involved in short food supply chains in comparison to the second group of respondents. When considering the specific resilience strategies, farms participating in SFSCs were definitely stronger in adaptability and transformability hence the differences were statistically significant. On the other hand, SFSCs farms represent (on average) smaller arable land and lower value of farm, but definitely higher land productivity. Moreover, they have higher investment-to-output ratio and are less dependent on subsidies. This indicates that small farms can develop well while finding a niche and they can achieve relatively high resilience, even in turbulent periods.

Counting the Costs: The economic impact of drought-induced water restrictions in the Catalan economy (Spain)

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Spain has long suffered from multiple drought episodes. Economic losses from drought events can be catastrophic, with a single event capable of causing losses of tens of billions of dollars. For example, the widespread European drought and heatwave of 2003 was estimated to have cost almost €15 billion. Droughts cause direct economic losses, which can propagate through the economic system affecting regions far from the original event and continuing to be felt after the drought has ended. This propagation of the direct effects causes widespread indirect effects. Very recently, Catalonia has faced its worst drought ever recorded since 1916. It has registered 500 mm less rain for three years, with the drought episode starting in the fall of 2020. To tackle this, the Catalan government declared a drought emergency in the Ter-Llobregat system and imposed sectoral water restrictions towards the end of 2023. This study estimates the impact of these drought-induced water restrictions on the agricultural and industrial sectors using a supply-side Input-Output (IO) model. Results highlight profound repercussions of water restrictions on sectoral outputs. While direct effects reveal substantial output reductions, accounting for indirect effects unveils a wider impact across sectors due to interdependencies. Results show that a focus only on the direct effects of the water restrictions would underestimate economic losses by €83 million in agriculture and €2.5 billion in industry. However, while the estimated impacts are substantial, the actual effects may be mitigated by sectoral flexibility, including importing inputs from unaffected regions and utilizing inventories. Acknowledging the limitations of the linear nature of the input-output model, we suggest that these estimates be taken as upper bounds, prompting policymakers to factor in sectoral adaptability when formulating policies in response to water constraints.

Farmers' intention towards investing in Agriculture 4.0 in marginal and non-marginal conditions

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Agriculture 4.0 is a revolution in agricultural cultivation that could be particularly relevant for durum wheat cultivation in marginal areas. Specifically, Agriculture 4.0, based on the advanced use of technology, would be useful for optimizing resource efficiency, improving sustainability, and increasing crop yields while also playing an important role in mitigating the effects of climate change by lowering greenhouse gas emissions and promoting adaptive farming practices. The cultivation of durum wheat in Sardinia has shown a drastic decline in the last decades. The adoption of Agriculture 4.0 could, therefore, play an important role in revitalizing production or at least slowing its drastic decline. The purpose of this study is to investigate for a sample of 131 durum wheat farmers in Sardinia located in marginal and non-marginal areas, the perceptions regarding the adoption of Agriculture 4.0. To achieve this objective, the unified theory of acceptance and use of technology (UTAUT2) served as the conceptual framework for investigating these farmers' behavior in adopting precision farming. We extended the UTAUT2 model by considering farmers' risk perception in precision farming. Financial facilities and easy access to technical advice appear to be the most relevant factors influencing the choice of investment in Agriculture 4.0 in cultivating durum wheat in marginal conditions in Sardinia. However, in non-marginal conditions, greater availability of information (knowledge) on adopting Agriculture 4.0 can influence their choice to adopt Agriculture 4.0. After discussing the results, policy implications are argued, such as the maintenance and possible improvement of specific measures in the PSR that facilitate the adoption of 4.0 technologies and the creation of easy access to technical advice or self-training tools in using Agriculture 4.0.

The role of behavioral barriers in consumer acceptance of underutilized and genetically diverse food

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In recent years, there has been a notable trend toward a global demand for sustainable nutrition, coupled with increasing concerns regarding biodiversity. Consequently, this has prompted the reintroduction of underutilized and genetically diverse crops into the market. Underutilized crops refer to species that were previously cultivated but are no longer grown due to economic, cultural, agronomic, or genetic factors. The primary reason for their neglect often lies in widespread agricultural practices such as monoculture and the intense competition inherent in the current global trade environment. These crops often embody cultural heritage and possess a diverse genetic profile specific to their region, thereby contributing to efforts aimed at preserving biodiversity. However, the revitalization of underutilized crops faces various hindrances, including behavioral barriers that influence consumer acceptance. These behavioral barriers stem from a variety of determinants, primarily driven by social and cultural influences, cognitive and emotional factors, attitudes towards food, health, and sustainability issues, as well as entrenched habits and past experiences. Understanding these behavioral barriers is pivotal in addressing and mitigating them to foster the successful incorporation of underutilized crops into existing dietary patterns and, ultimately their successful integration into the market. Given this context, this review aims to highlight the predominantly studied determinants related to behavioral barriers and their underlying mechanisms, with a special focus on underutilized crops. Peer-reviewed articles with case studies focused on the revitalization of underutilized crops were examined to reveal the current research direction regarding their market integration. The findings were discussed concerning potential marketing strategies to provide behavioral insights to marketing strategists and policymakers.

Incentive mechanisms to improve data availability in food systems

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The aim of this study is to gain an understanding of the Scottish food system data availability, quality and uncertainty, and identification of key gaps that will hinder food system mapping and intervention design/implementation. While policy and research have set out more consistently to think about food supply and demand, and associated socio-economic and environmental impacts through a systems lens, often this is constrained by data availability. One of the main barriers to a three-pillar assessment of food systems is the uneven availability of data, varying methods of data collection, varying types of data and accessibility level, standardisation issues, in relation to each of the elements encompassed by the food systems. A group model building workshop with stakeholders representing different stages of the agrifood supply chain was held to assess, and critically appraise the evidence highlighting potential gaps in the Scottish food systems data, identify and prioritise research/policy requirements to resolve data gaps. Factors influencing availability of food systems data include information sharing legislation and anonymity requirements leading to geographical aggregation of data; obsolete data sharing culture; need for improved data skills and understanding of data ownership/purpose, access/navigability, consistency/measurability; cost aspects including uncertainty and disproportionality to identified research/policy needs. Most factors influencing data availability are exacerbated by the rhythm of change in policy/research priorities leading to rapid shifts in data analysis needs from distinct to interlinked, cross-section to time series, single field to interdisciplinary, node to whole supply chain, supply and demand/diet to causes and wider (health/environmental) impacts, linear to circular, domestic to cross border, i.e., the food system. Identified incentives and solutions include targeting, prioritising and monitoring of data collection by relevance to evolving research/policy needs; mechanisms for ensuring consistency of data reporting; mechanisms for facilitating awareness of existing data e.g., incentives for data owners to catalogue data; skills and capacity building into interdisciplinarity and systems thinking; mechanisms for institutional harmonisation of data needs through interlinked data collection and harmonised prioritisation of data needs; behavioural and market mechanisms for promoting data sharing culture.

How environmentally friendly are the eight largest German food retailers?

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The global food system is responsible for 26-34% of global greenhouse gas emissions. Furthermore, it has substantial negative impacts on biodiversity, soil erosion, water consumption and water pollution. Food retailing plays a central role in the food system, as it can significantly influence both food production and consumption. The aim of this project was to assess the extent to which Germany's eight food retailers, defined as those with the highest turnover, are using their scope to instigate action targeted at making the food system more environmentally friendly. To this end, we evaluated these companies according to an evaluation grid with 22 areas of activity, 43 indicators and 112 sub-indicators. The assessment referred to the year 2020. The present study shows that all eight food retailers examined make insufficient use of their scope for action in the areas of supply chain, own locations and consumption. Although it is true that individual companies demonstrate notable performances in various areas of activity, these are not sufficient to make an overall significant contribution to the necessary transformation of the food system. Therefore, we recommend that the companies implement their sustainability management in a considerably more systematic, and consequently, more effective way. This includes setting consistently verifiable targets for environmental sustainability, investing in better data capabilities, and linking sustainability management more closely with the business, purchasing and category management. Given the overall mediocre performance of the companies, we conclude that the current policy framework needs to be changed to enable food retailers to improve their environmental performance without suffering significant competitive disadvantages. This requires an effective policy mix of regulatory measures combined with financial incentives. In addition to general recommendations, such as the internalization of externalities, we recommend addressing the key drivers for companies; both on the supply and demand side. These include the introduction of minimum standards in raw material purchasing and restrictions on the sale of particularly environmentally harmful products, such as food transported by air-freight. In addition, a framework should be established to enable transparent and comparable sustainability reporting by the companies.

Sustainability Pathways of Ecuadorian Cocoa Farming Communities: A Photovoice Journey towards Post-Growth Agrifood Systems

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The term "sustainability" in agrifood systems often lacks precise meaning, despite its frequent use. Current sustainability pathways are often influenced by entrenched paradigms, that demonstrate limited alignment with planetary boundaries essential to tackle climate change and food security threats. To remain within planetary boundaries, we may need to supplant existing paradigms and transform towards a post-growth agrifood system based on principles of sufficiency, regeneration, distribution, commons, and care. This study investigates the alignment of sustainability definitions and criteria co-created by farming communities with post-growth metabolism principles, focusing on the cocoa value chain. We engaged 43 cocoa farmers in Ecuador's socio-ecological distinct coastal and Amazonian regions to document their sustainability perspectives. Using the Photovoice method over four weeks with farmer groups in both regions proved effective in overcoming social and language barriers, allowing communities to express their strengths and concerns through photography, written interpretations and focus group discussions based on their visual inputs. Furthermore, farmers identified key actor groups most relevant to promoting or hindering positive change towards a post-growth agrifood system. Results indicate a strong emphasis on social aspects of sustainability, with coastal participants highlighting civil security, corruption, and farm succession, while Amazonian participants focused on indigenous Kichwa culture and harmonious living with nature. Differences in sustainability perceptions were observed based on gender and production system type. The sustainability criteria demonstrated significant alignment with post-growth metabolism principles, with identified influential actors for each principle. The study highlights the effectiveness of photography in communication, revealing intimate insights into farmers' lives and their context-specific sustainability challenges. The findings suggest that universal sustainability frameworks may not fully address the unique challenges faced by these farmers. However, the strong alignment with post-growth principles indicates potential pathways for transformation within agrifood systems. This research underscores the importance of transdisciplinary collaboration and respecting stakeholders' cultural values and worldviews in sustainability research. It provides actionable pathways towards fostering post-growth transformations and presents a rich collection of nearly 500 images with participant interpretations, enabling broader audiences to engage in discussions about the sustainability of food systems.

Food Security Dynamics Across Diverse Regions in Sulaymaniyah, Iraq

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Various local conditions that can not be easily changed by the household negatively affect its food security. In order to examine local variations in food security, the main objective of the study was to assess the impact of locational determinants, including rurality of settlements, altitude, conflict and market distance, on household food (in)security. This study was conducted in the Sulaymaniyah province of the Kurdistan Region of Iraq characterised by armed conflict in rural areas and diversified locality conditions. The data was collected from 391 respondents from May to July 2021 and analysed using the Ordered Logit Model. Food security was measured by the Food Consumption Score (FCS) and the Household Food Insecurity and Access Scale (HFIAS). The summary results of FCS show that 2% of households are severely food insecure (poor), 6% are on borderline, and the rest have acceptable food security status. The results of the HFIAS show that 13.8% of respondents are severely food insecure, 26% are in moderate food insecurity status, 10.2% are mildly food insecure, and 50% of the households are considered food secure. The results show that conflict has a negative impact on household food security, and households in urban and highland areas have a better food security status compared to those in rural and lowland areas. Also, better access to the food market positively influences household food security. To reduce food insecurity and decelerate the spread of conflict, households in rural areas and particular in dry lowlands needs to be supported through direct payments, food aid, and infrastructure investments to facilitate access to the food market.

Identifying motives and barriers among Greek farmers towards innovative pest management adoption

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One of the core aspects of the Green Deal is the European Union's commitment for transition to more resilient food systems. To achieve this target, the European Union has adopted various policies, actions plans and strategies. Among them, the Directive for Sustainable Use of Pesticides is of particular interest for food security because reducing chemical pesticides is associated with environmental benefits and enhanced food quality that contributes to consumers' health. This article investigates the factors affecting Greek farmers' intentions towards adopting innovative pest management in vineyards, peach orchards, citrus and horticultural crops (e.g., greenhouse tomato and pepper). Specifically, such an innovative pest management includes the use of smart farming technologies (e.g., decision support systems, sensors, smart phone applications, etc.), biopesticides, functional biodiversity (e.g., cover crops) and beneficial insects. Furthermore, the rationale of selecting these crops is twofold. They provide high economic value for both local communities and the national economy, and they are pesticide-intensive. Consequently, the main objective of this study is to answer two fundamental questions. Firstly, what are the motives and barriers farmers face regarding the adoption of innovative pest management? Secondly, do any motivational differences exist regarding innovative pest management adoption between farmers operationalized in cultivating different crops? To achieve this, we employ a comprehensive model, extending the Theory of Planned Behavior. This model incorporates descriptive and personal (or moral) norms, openness to innovation, and concerns (health, environmental and risk) as additional constructs. We also consider farmers' demographic characteristics (such as age and education), farm structural characteristics (like size and profitability), and the institutional environment (including institutional techno-economic support and advisory). Addressing these questions can help us better understand farmers' decision-making processes. This understanding can lead to the development of more effective policies and tools, leading to enhanced compliance with national and European regulations and directives.

Consumer Preferences toward Eco-labeled Fruit and Vegetables Comparing Short and Export-Oriented Supply Chains: A Cross- National Study

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Objectives: Growing awareness of the environmental impact and safety aspects of fruit and vegetable (F&V) production has increased consumer interest in ethically and environmentally responsible products. This study therefore addresses these issues by examining the factors that influence consumers' preferences for F&V with ecolabels, focusing on their interest in the information on labels, their concern for the environment and positive attitudes and trust in these labels within two distinct supply chains—short food supply chain (SFSC) and export-oriented supply chain (EOSC) across three European Mediterranean (EU-MED) countries (Italy, France, Greece). **Research Question:** This study aims to examine the main factors influencing consumer' preference for labelled F&V, and difference between the preferences in two distinct supply chains in three Eu-Med countries. **Theoretical framework:** The information on labels serves as a guide, shaping consumer preferences and attitudes. It provides details like product origin, expiry date, and certifications such as organic or environmental labels. Previous research on consumer behavior has shown that people who are more interested in information and informed about the environmental impact of their choices are more inclined to choose sustainable products. Similarly, environmental concern and awareness lead to purchasing decisions for sustainable and environmentally friendly options. Furthermore, according to the literature this study assumes that positive attitudes and trust in certifications positively can influence consumers' preferences for F&V with ecolabels. **Methodology:** The data was collected in June 2023 via an online survey platform in three EU-MED countries, namely France, Greece and Italy. In order to identify the most important and significant factors influencing consumer preferences, the Partial Least Square Structural Equation Modelling analysis were used to investigate consumer preferences for F&V with ecolabel. **Main expected results:** According to the results consumer preferences in both short and export-oriented supply chains are significantly influenced by interest in information as well as positive attitudes and trust in ecolabels. However, concern for the environment only affects consumer preferences in the EOSC, while it has no significant effect in the SFSC. As for the SFSC, significant differences were found between the consumers preferences within the countries studied.

Food Self-Sufficiency under Limited Resources: Economic Analysis for the Case of Israel

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Major food-exporting countries often respond to global crises that threaten their local food supply by imposing food-exports restrictions, which, in turn, causes further disruption of global food supplies and food price inflation. We develop a partial equilibrium positive-mathematical programming model for assessing the agro-economic implications of policies to stimulate food self-sufficiency as a strategy to reduce the dependence of a developed country on food imports, and thereby the exposure to shocks in the world food markets. We apply the model to the case of Israel, whose limited land and water resources entail high dependency on food imports, which are threatened by the country's geopolitical situation. We find that, based on its current population and agricultural resources and technology, and if livestock production is excluded, the country can technically self-supply the amounts of vegetative food products recommended for consumption by the EAT-Lancet Commission. This self-supply policy requires shifting local agricultural resources from the production of fruits, vegetables and tubers to the production of crops that are currently imported in large amounts, including cereals, oils, fats, legumes, seeds and nuts. These changes inflict large welfare loss, where most of the burden is carried by the farming sector. Accordingly, incentivizing high levels of self-sufficiency by the use of subsidies would entail enormous governmental expenses; therefore, more direct intervention methods may be considered (e.g., command-and-control regulations). We find that practical extension of the land allocated to agricultural production and maintaining stocks of the main storable vegetative food products can considerably increase the feasibility and reduce the welfare burden associated with self-supply of food for the country's population in the coming decades.

Determine the impacts of Climate change and Biodiversity on food security – Insights from the literature

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Objective The objective of this paper is to review the contemporary literature to determine the key drivers of food security coming from climate change and biodiversity. Climate change and the loss of biodiversity have become major trends globally, thus, it is important to understand how these two trends can affect food security. **Research question(s)** This paper aims to answer the research question: What are the important climate change and biodiversity-induced drivers of food security? **Methodology** This paper adopts the Systematic literature review approach to find the most relevant papers to the topic and synthesize the key insights from those selected papers. Web of Science database was used to initially search for scientific research addressing the topic of climate change – biodiversity – food security. After two rounds of screening, 342 papers were selected. **Findings** A thematic analysis was conducted to determine and categorise the drivers of food security, in relation to climate change and biodiversity. This study found 11 groups of climate change drivers, and 9 groups of biodiversity drivers, which contribute significantly to food security. All pillars of food security, namely availability, accessibility, utilisation, and stability, were found to be impacted by climate change and biodiversity drivers. Among these pillars, availability and accessibility were under significant influences by the drivers, as many of them directly affect the ability to produce food and generate income via agricultural/ fishery activities. **Contributions** The findings in this study make contributions to the scientific communities and practitioners. Particularly, this study provides a holistic understanding of the extant literature for future work to investigate further. Moreover, this study informs businesses and policymakers about important climate change and biodiversity-induced drivers, which need to be considered for maintaining an adequate level of food security.

Do Timing and Methods Impact the Effectiveness of Incentives? A Narrative Review of Education-Based Interventions for Promoting Plant-Based Food Choices Among Students in Developed Countries

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Background Promoting plant-based food consumption is crucial for addressing climate crises, such as global warming. Economic policies can enact systemic changes; however, the current policy landscape predominately focuses on designing fiscal instruments like taxation and consumer studies overlook the population under 18 years old. To alter food choices, education-based interventions often struggle to demonstrate sustained effectiveness, particularly after the intervention period. This paper fills the gap by reviewing the up-to-date literature on education-based interventions in promoting plant-based food choices among students in developed countries. **Target Audients** Behavioral economists aspire to broaden their expertise and proficiency in applying rigorous scientific testing methodologies to design experiments within public health contexts. **Objective** To investigate how education-based interventions in educational institutions (primary, secondary, and university levels), leveraging incentives (both financial and physiological), can shift students' food preferences away from animal-based foods towards plant-based options in developed countries. **Scope** We answer three research questions throughout this narrative review: RQ1 What are the characteristics of education-based interventions used to influence students' plant-based food choices within educational settings as reported in the literature; RQ2 How do these interventions report their effectiveness among students of different age groups within educational institutions in the literature; RQ 3 How might interventions be redesigned by adjusting incentive mechanisms using principles from behavioral economics. **Theoretical Framework** Integrates insights from psychology, neuroscience, and sociology, aligning with the interdisciplinary approach of behavioral economics, including bounded rationality and psychological incentives, social cognitive development, and moralization processes, all contributing to comprehending the rationale behind plant-based food choices. **Methodology** A narrative review **Preliminary Results** The impact of education-based interventions varies across age groups and aligns with cognitive developmental stages. For school children, taste remains a dominant factor driving food preferences and interventions focused on providing information only have shown limited effectiveness in significantly altering attitudes or behaviors towards plant-based food. Conversely, among university students, all education-based interventions (information-oriented and activity-oriented) have yielded substantial outcomes.

Performance of Mutual Funds with Biodiversity Targets

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Background and objectives Recent years have witnessed a sharp increase in the number of funds that invest in companies with a positive contribution to the achievement of the UN sustainable development goals (SDG). The funds often target one specific sustainability target such as reduction of carbon emissions, impact on water quality or biodiversity preservation. Very little has been reported in the economic literature so far about how, with which level of success or at which cost the funds have implemented this reorientation of their investment objective over the past years. In this paper, we provide an overview of the most recent data reported by the funds on the European ESG Template (EET) for biodiversity-linked targets, analyze that data and explore the risk-return-biodiversity performance of the funds that recently committed to consider biodiversity-linked Principal Adverse Indicators (PAI). **Research questions** - What are the main characteristics of mutual funds with biodiversity targets? - What trends can be observed in recent reporting of funds that commit to consider biodiversity-linked Principal Adverse Indicators (PAI)? - What is the risk-return-biodiversity performance of mutual funds? **Theoretical framework** This paper will use mainstream techniques used in productivity & efficiency analysis (mostly used in production economics) as well as portfolio construction techniques from the Modern Portfolio Theory. **Methodology** The paper uses Data Envelopment Analysis on data of European mutual funds to construct a piecewise linear frontier in the dimensions of risk, return and impact on biodiversity. The data comes from the Lipper database (accessed from Lipper for Investment Managers or from London Stock Exchange Group) over the years 2010 to 2023. **Expected results** The paper provides an overview of the main biodiversity targets that mutual funds mention in their prospectus as being part of their investment objective, as well as the PAI they report to consider in their EET. It provides descriptive statistics on the most up-to-date reported data among all European funds. Next, it provides performance scores (efficiency measures) of individual funds. The efficiency scores provide insight into the extent to which funds can enhance their performance in the three dimensions; such insight can help funds managers or investors in their decision making.

Agricultural Knowledge and Innovation System (AKIS) in Greece: From diagnostics toward operational practices

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AKIS is considered an adaptive system that supports innovation processes and knowledge-building in agriculture. However, a key issue for policymakers is determining effective and efficient approaches to foster innovation in these complex, multi-stakeholder environments. This paper aims to provide an empirical answer to how the AKIS in Greece can benefit from evaluating its internal and external environment and identifying supportive policies that could contribute to improving innovation processes. An extensive literature review was used to determine the strengths, weaknesses, opportunities, and threats (SWOT statements). A structured questionnaire with four sections was then used, covering strengths (13 factors), weaknesses (11 factors), opportunities (7 factors), and threats (8 factors). The questionnaire utilised a 5-point Likert scale, and 61 expert representatives, mainly senior managers from various organisations, (policy, education, research, consulting, agricultural cooperatives, credit, private companies, and farmers) participated in the survey. Data was collected between December 2022 and March 2023 using an online survey tool following phone contact. The collected dataset was analysed using a quantitative SWOT analysis and a Strategic Position and Action Evaluation Matrix (SPACE). Descriptive statistics indicators such as mean scores, standard deviations, and standard errors were used to present the main results. The findings indicate that AKIS has more opportunities than threats in its external environment, with weaknesses outweighing strengths. Based on the SPACE table, the strategic position of AKIS in Greece is competitive. Decision-makers, local authorities, and other stakeholders should seize opportunities to address system weaknesses. The analysis provides a starting point and valuable guidance for decision-makers and other stakeholders to enhance AKIS.

Modeling the emission reduction potentials of non-CO₂ mitigation measures for Austrian farms

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Agriculture significantly contributes to non-CO₂ greenhouse gas (GHG) emissions, namely methane (CH₄), nitrous oxide (N₂O), and reactive trace gases, such as ammonia (NH₃). These emissions result from enteric fermentation of livestock, manure management and agricultural soils. The reduction potentials of mitigation measures in agriculture have become a key priority for policy makers, researchers and stakeholders. However, mitigation measures at the farm level incur different marginal abatement costs (MACs) due to biophysical, technological and managerial factors. Hence, farm-specific calculations of MACs are still limited available to support tailoring of measures. Therefore, our study aims to address this gap by (i) modeling non-CO₂ GHG emissions, (ii) computing MACs of mitigation measures and (iii) identifying cost-efficient mitigation measures for Austrian farms using the Farm Optimization Model FAMOS. FAMOS is a mixed-integer linear farm optimization model implemented in GAMS. It maximizes farm net returns subject to the farm's resource endowments such as available land, livestock housing capacity and farm family labor. The model accounts for agronomic production relationships (e.g., fertilizer and feed balances), farm management practices and legal compliances (e.g., measures and payments as set in the EU's Common Agricultural Policy, fertilizer intensities within the Austrian agri-environmental programme). We have extended FAMOS with a non-CO₂ GHG emission accounting module following the guidelines provided by the IPCC. This module applies farm- and management-specific emission factors, and accounts for farm-specific mitigation measures. Data from various sources (e.g., Farm Structure Survey, Integrated Administration and Control System) are used as model inputs. FAMOS is solved for each individual farm in Austria. The results show that the MACs of mitigation measures differ between farm types and agricultural production regions. For instance, specialized farms with few and labor-intensive management options face higher MACs. The MACs are lower for managerial measures (e.g., changes in fertilizer management), compared to technological (e.g., changes in livestock housing) and agronomic measures (e.g., cover cropping). These results may inform farmers, farm consultants and policy makers in tailoring the implementation of cost-efficient mitigation measures at farm level.

Transformative Agri-Food Supply Chains for Climate Resilience – Which indicators are suitable to measure resilience and social transformation?

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Resilience in agri-food supply chains refers to the ability of the system to withstand and recover from various shocks and stresses while maintaining its functionality. However, there are several challenges and problems that can hinder the resilience of agri-food supply chains, like climate change impacts, long supply chains, environmental degradation, as well as social and economic disparities. Addressing these problems requires a holistic and collaborative approach that involves various stakeholders, including government bodies, farmers, researchers and industry participants. We work on transdisciplinary research that unites stakeholders from diverse sectors, including coffee, cocoa, herbs, and livestock farming, with a specific focus on family farmers. Grounded in national and international best-practice examples, our research aims to advance our understanding of effective strategies for fostering resilience and social transformation within the agri-food sector. We develop indicators for measuring resilience and social transformation within agri-food supply chains, aligning with the Proximity Framework by Edelman et al. (2022) and incorporating the Resilience Concept from relevant literature, which we want to present and discuss in this session. Through consultations and collaborative discussions scaling-out, scaling-up, and scaling-deep strategies (Moore et al. 2015) will be explored, to inform effective approaches that directly profit agricultural communities and the industry sector. We will apply gender-transformative approaches and feminist perspectives throughout the research process, to ensure a nuanced understanding of gender dynamics in agri-food-supply chains. The inclusion of diverse sectors is strategically motivated, providing a comprehensive exploration of resilience and social transformation, with a specific emphasis on improving the livelihoods of family farmers and directly profiting agricultural communities.

Trade for nutrition: Evidence from Morocco

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Problem statement/Aim Over the past few decades, there has been a significant expansion of international agri-food trade. Especially for lower-income countries, this has transformed the structure of their agri-food exports, with a substantial increase of horticultural exports. However, Trade's impact on lower-income countries' nutrition remains unclear. While some advocate for nutrient-focused systems over general food supply increases, the actual effect of trade on essential nutrient availability is under-researched. From a global perspective, some authors found that trade did not substantively improve the nutrient-adequacy of most lower-income countries. Yet, others found the opposite, that the ability of many low-income countries to meet their aggregate nutritional needs in today's world would be less without trade. Overall, most of these studies focus on aggregate data, looking at calories and food supply, but less on macro/micro-nutrients. Our study aims to analyze national nutrition security and the role of trade openness in promoting nutrition security. We focus on Morocco as a case study, a leading African exporter of horticultural products.

Methodology First, the study examines the Moroccan food balance of food groups (meat, cereals, eggs...). This is a tangible approach to see how well Moroccan food needs are satisfied. Then, to further explore dietary patterns and potential nutritional deficiencies, we quantify the nutritional trade balance of calories & proteins and some of the most important micronutrients (Iron, zinc, vitamin A). This is done by compiling food composition data of these micronutrients for the traded agricultural products and matching them with detailed trade data. We use data from FAOstat for the period 1990-2021, during which agri-food exports and imports have rapidly increased.

Results Morocco has relied on imports to meet dietary energy needs but has been self-sufficient for micronutrient needs. The results also show the role of imports in the stability of nutrient supply at the country level.

Conclusion This study offers an approach to assess nutrition security on a national level for a developing country. It provides a method to track progress in achieving food security by ensuring an adequate supply of nutrients to meet the needs of the population.

Integrated Assessment of EU Soil Biodiversity Policies: Synergies and Trade-offs Among Policy Objectives

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Integrated Assessment of EU Soil Biodiversity Policies: Synergies and Trade-offs Among Policy Objectives

Introduction No-tillage agriculture is a widely adopted management system designed to lessen soil erosion, reduce input costs, and maintain crop productivity over the long term. Organic farming practices are also known to improve soil quality through increased organic matter content and improved microbial activity. The net effect of these soil practices depends heavily on the trade-offs between the agricultural sector and greenhouse gas (GHG) emissions. In addition, soil biodiversity practices can affect farmers' profits by reducing costs, and creating potential synergies. Although these trade-offs and synergies are particularly important in the EU in the light of new climate and emissions policies, they have not been thoroughly addressed in the economic literature.

Objectives This analysis aims to examine the impacts of different soil biodiversity practices, namely organic farming and no-tillage scenarios, on the EU agricultural sector, GHG emissions, trade, land use, and productivity. In addition, we aim to highlight the potential synergies and trade-offs between different soil biodiversity policy objectives in EU countries.

Research Questions What is the potential impact of soil biodiversity practices on the EU's agricultural production? How do soil biodiversity practices affect GHG emissions in the EU and globally? What are the differences between various soil biodiversity practices in terms of their impact on agriculture and GHG emissions?

Methodology For our analysis, we apply the global general equilibrium model MAGNET, which relies on the Global Trade Analysis Project (GTAP) database to simulate the potential effects of different scenarios. The model encompasses 141 regions (121 individual countries) and 113 sectors.

Main Results Organic farming practices will decrease total grain production, with a larger decline under the "Organic production" compared to "No-tillage" scenario. Both practices have a limited impact on land use. Emissions will significantly decrease, with no discernible difference between no-tillage and organic practices in terms of emissions. It is recommended to support "No-tillage" practices due to their flexibility in adapting to regional conditions compared to the stringent requirements of organic farming.

Incorporating Sustainability in the Modern Understanding and Quality Assessments of Agrarian Governance

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There is a common understanding among researchers, policymakers, and practitioners that the (quality of) governance is a key factor for the effective sustainable development of agri-food systems. However, traditional approaches for defining and assessing agrarian governance incorporate some or several components such as Agents, Means, Processes, and Order, while Sustainability Issues are largely ignored. This presentation aims to suggest a holistic framework for an adequate understanding of the system of agri-food governance and for assessing its quality based on the interdisciplinary New Institutional Economics methodology. Agri-food governance is studied as a complex system including agrarian and related Agents involved in the decision-making; diverse Means (rules, forms, mechanisms) that govern the behavior, activities, and relations of involved agents; Processes related to making managerial decisions; a specific social Order resulting from the governing process; and outcomes of the functioning of the system in terms of realization of Sustainable development goals. A holistic GAMPOS (Good-Agents-Means-Process-Order-Sustainability) framework for understanding and assessing the governance in the specific (socio-economic, institutional, natural, etc.) conditions and challenges of Bulgarian agriculture is presented which includes 11 Good Governance Principles, 21 Criteria, and 36 Indicators and Reference Values. The evaluation of the country's agrarian governance quality, based on statistical and expert data, found that its overall quality is at a moderate EU level. In terms of Sustainability, the quality of agrarian governance is at a good (European) level, while for the Process, Means, and Order components it is at a satisfactory level. The quality of agrarian governance is the highest in terms of Equity and Solidarity, and the Good Working Public Sector, while in terms of (Good) Leadership, Working Private Sector and Markets, Transparency, Stakeholder Involvement, Efficiency, Legislation, and Informal Rules, it is at a satisfactory level.

Transformative policies for dynamic legume value chains

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Despite the potential of legumes to enhance the sustainability of arable cropping systems and the quality of farmed animal and human diets, the production and consumption of legumes in Europe are low, whereas their demand for feed is high. This insight, known as the legume paradox, was shared by almost 600 stakeholders. We observed a strong interest among various participants in the value chain in creating more sustainable food systems where legumes play a crucial role. Legumes have been central to food policy discussions, giving rise to conflicting viewpoints and claims from different disciplines. Additionally, legumes have led to competing stakeholder ambitions and opposing visions for the future of food (intensification vs agroecology). So, then, who is responsible for this situation? How can research better support farmers in developing cropping systems that include legumes? The presentation provides a sociological perspective on stakeholders' policy evaluation and identifies intervention points to address the barriers hindering a shift to sustainable agri-food systems in the EU. By unravelling this intriguing paradox, it delves into the factors driving legumes to the forefront of future food despite their low production and consumption.

Cultivated biodiversity management and the impact of sustainability attributes on market prices: the case of Italian lentils

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Biodiversity loss is one of the most critical environmental issues facing the planet, and has received little attention by researchers. This study investigates the management of biodiversity within agri-food supply chains, the choices of large retailers and the appreciation of consumers. The main focus of this research is on “cultivated biodiversity”, intended as the diversity of plants and varieties grown, processed, and consumed. As a case study, the lentil value chain in Italy is considered. Despite their environmental value and important role in human nutrition, legumes, including lentils, have been underestimated. Nevertheless, there is a renewed interest in their consumption due to regional specialization, varietal diversity and their role in the transition towards sustainable production. Recent years have witnessed a rise in consumer awareness regarding sustainable food, healthier and plant-based diet and local food systems. Different surveys and analysis approaches are used to evaluate the behaviour of value chain actors, such as semi-structured interviews with actors, as well as the hedonic analysis of retail prices allow to have a clearer vision of the current situation and underscore the opportunity of incorporating biodiversity considerations into policy frameworks and value chain strategies to promote a sustainable biodiverse agri-food system. Key findings of the study highlight a growing recognition of the importance of biodiversity. Decision-making processes within these supply chains are influenced by various factors. Economic concerns, such as price inflation, pose primary challenges for stakeholders across different industry sectors. Market-related aspects, long-term contracts, and concerns about climate change play significant roles, highlighting the complex decision-making landscape within agri-food supply chains. The analysis in retail stores with consumers indicate that Italians have a positive appreciation for lentils with organic certifications and references to geographic and territorial characteristics. However, the diversity is mainly appreciated and identified with origin rather than with varietal diversity. Too much diversity on retail shelves may confound retailers and retailers are already focused in offering diversity in the form of different labels in including private labels. These conclusions should be carefully considered in order to define future strategies of cultivated diversity.

Promoting Sustainable Supply Chains through the Consumption of Certified Tropical Fruits in the Central European Region

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Consumers in the Central European region are increasingly demonstrating an interest in sustainable and ethically certified products. This trend is driven by raising awareness of environmental issues, ethical concerns regarding labor practices, and a growing demand for healthier, responsibly sourced food options. Consumers are more conscientious about the impact of their purchases, favouring products that support fair trade, organic production, and reduced carbon footprints. Retailers and producers are responding by offering a greater variety of certified organic and Fairtrade products. Concurrently, the popularity of tropical fruits in European countries is significantly increasing due to their taste and consumer appeal, which is bolstered by the positive health effects of these fruits. This study aimed to evaluate the potential of strengthening the sustainability of tropical fruit consumption in the Central European region from the perspective of final consumers. A total of 2,247 respondents participated in the survey. The data were analyzed using ANOVA to determine the association between tropical fruit consumption attitudes and respondents' characteristics, and the Structural Equation Model to analyze the factors influencing Fairtrade engagement. Our results indicated that bananas, pineapples, mangoes, and avocados were among the most consumed fruits by Czech consumers. For detailed analysis, we focused on bananas and avocados as the two most consumed tropical fruits with the strongest impact on the social and environmental conditions of production in tropical regions. The results showed that Czech consumers exhibited the highest level of knowledge about Fairtrade certifications, with up to 75% of respondents expressing trust in this certification. The findings confirmed an increasing trend similar to that observed in other Western European countries, where consumer preferences align with global sustainability and ethical standards.

Organic consumers' acceptance of food produced with recirculated nutrients

SMED sinne

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Sufficient supply of nitrogen and phosphorous is crucial for feeding a growing world population. Declining phosphorous reserves and huge environmental and climatic consequences of nitrogen production therefore make re-cycling of nutrients from urban areas and the food-industry important. Recycling also fits well with an emerging wish for a more circular economy in the society, and aligns perfectly with the idea behind organic food production. However, it is unsure, how recycling affects the credibility of food-production in the eyes of the consumers. The aim of this paper is to explore consumers' WTP for food produced with re-circulated nutrients from biological households and food-industry waste, as well as biosolids from wastewater plants. We analyze to which extent attitudes, values as well as perceived risks and benefits of recirculation affect this WTP and explore differences between the organic and the conventional consumer. We issued an online survey with a choice experiment to 3712 members of a home-scan panel from GfK in December 2022. Based on a random coefficients logit model we estimate the average consumers' WTP for bread and carrots grown with recirculated nutrients and derive individual WTP based on conditionals. To estimate the importance of values and attitudes on consumers' WTP, we extend the Theory of Planned Behaviour Behavior with factors important for consumers' acceptance of new food production technologies. This include; perceived risks and benefits of recirculation, the food disgust scale, social norms, environmental values and attitudes towards sustainability, recirculation and organic production. We find; positive WTP for food produced with household waste, which increase with the level of organic consumption, negative WTP for food produced with food-industry waste and especially bio-solids, decreasing in organic consumption. This might be due to that organic consumers perceive household waste to be less risky and have less trust in the food-industry. Additionally, it is important for heavy users of organic food that the recirculated nutrients originate from an organic source. Perceived risk and social norms are most important for consumer WTP for food produced with recirculated nutrients. This applies across all levels of organic consumption.

From Close to Distant: Exploring Consumer Preferences for Lignin-Based Products Across Various Product Categories

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In the sustainable bioeconomy, biomass sourcing and bio-based product creation play vital roles. Biorefineries efficiently process plant components, yielding valuable by-products like lignin, sourced from plant cell walls. Despite its potential in various industries, lignin is often incinerated for energy. Its versatile properties make it suitable for diverse bio-based consumer products. However, consumer perception and acceptance of lignin-based items remain largely unexplored, as many are unfamiliar with lignin. Current consumer studies either use quantitative approaches or qualitative methods with guided keywords, but none use free association tasks to explore unprompted perceptions of lignin-based products. This study addresses this gap by exploring consumer perceptions of lignin-based products and identifying drivers and barriers to their acceptance. The objectives are to understand consumer perception and attitudes towards lignin-based products and to gain insights into the factors influencing acceptance of three lignin-based products with varying consumer proximity. This understanding is crucial for tailoring the innovation process and communication strategies to promote market success. To understand consumer perceptions and attitudes towards lignin-based products and explore the factors influencing the acceptance of three specific lignin-based products, we used focus groups grounded in morphological market research principles, complemented by projective techniques such as concept maps. Six face-to-face focus groups will be conducted in the Cologne-Bonn area in early June 2024. Participants will be recruited by a marketing agency based on gender, age, education, and family status. To explore consumer attitudes and acceptance of lignin-based products, we focused on reusable cutlery, children's toys, and flowerpots. These products were chosen to represent varying levels of consumer interaction and market readiness, aiming to identify various drivers and barriers influencing perceptions. Based on a literature review of bio-based product acceptance, we assume factors like price, product category, functionality, material composition, the origin of the raw material, safety, and trust to play a role. However, since we are conducting qualitative focus groups, we are not formulating hypotheses. Instead, we aim to explore various perspectives, revealing different dimensions and nuances of factors driving the acceptance.

Effectiveness of nudge- and boost-based interventions to foster sustainable food choice: The role of moral agency

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Global food systems contribute approximately 30% to greenhouse gas emissions. Therefore, discussions about changing eating behavior, particularly reducing livestock-based products consumption are ongoing. Behavioral interventions, including nudges, have been explored for their potential to influence eating habits. Despite their success in many studies, ethical concerns persist, with debates focusing on autonomy issues and long-term effectiveness. In contrast to nudges, boosts aim to provide people with skills and tools to make better choices. However, research on the effectiveness of boosts is limited. Additionally, few studies analyze how boosts and nudges affect moral agency and perceived responsibility. Thus, the main aim of the present study is to investigate the short- and mid-term effects of nudges and boosts on sustainable eating behavior and to assess how perceived responsibility mediates these effects in the context of moral agency. To achieve this aim, an experimental online study with 738 participants was conducted using an online food delivery service setting embedded within an online survey. The experiment followed a 2*3 mixed design, with the between-subject factor (nudge, boost, control) and the within-subject factor (intervention period and follow-up). In the intervention period, respondents were randomly assigned to a control, nudge-based, or boost-based experimental burger menu choice. The default option was chosen for the nudge intervention, while the boost intervention was implemented through transparent communication of the intervention, emphasizing information on CO2 emissions, and offering clear sustainable food choice guideline. In the follow-up period, participants selected a burger without experimental manipulation. The study assessed intervention impact on subsequent menu choices' sustainability (measured by CO2 footprint), along with perceived responsibility, environmental concern, and socio-demographic variables. Approval for the study was obtained from the University's Ethics Committee, and it was pre-registered on OSF. First results reveal that boost interventions have limited potential to reduce the carbon footprint of chosen meal options compared to nudges, which appear more effective, though only in the intervention period. While perceived responsibility emerged as a significant driver of sustainable food behavior, it did not mediate the relationship between the interventions and the CO2 emissions of the chosen burger menu.

Explaining Consumers Online Food Purchase Intention through Technology Adaptation Model (TAM): A Case of Antalya Province/Türkiye

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Digitalization is now considered one of the most important trends changing society in worldwide. Digitalization among households and digital food marketing channels targeting to households grocery shopping has been rapidly increasing as well in Türkiye, the studies focused on determining the impact of these developments on consumer food purchasing behavior are still missing in Türkiye. The aim of this study is to "reveal whether the technology adaptation model (TAM) is capable to understand consumers' behaviour of online food purchasing behavior in Türkiye". The study is used a cross-section data obtained from consumers are residing in the three major central districts representing 50% of population lives in Antalya province. Size of sample determined by simple random sampling consist of 300 respondent aged 18+ and representing households food shopping. The survey instrument included questions corresponding to demographic, socioeconomic and economic characteristics of respondent's household, internet access and credit cards owner status and use online shopping for food purchasing, and scale items (measured by 5-point Likert scale) of the technology adaptation model (TAM): consisting Perceived Usefulness (PU: 3 items), Enjoyment (E:4 items), Perceived Ease of Use (PEU:3 items), Trust (T:4 items), Attitude (A:3 items), Social Influence (SI:3 items), and Intention to Purchase food products online (BI:3 items). Besides descriptive statistical results of the sample data, Structural Equation Model (SEM) was employed to test the TAM. The descriptive results indicate female and married share of respondent is 62% and 66%. The majority of respondent falls in z-generation age category (%37) and 46.6% of them use online shopping channel for food. Statistically significant relationships are found between income, education, employment and age category. Regarding SEM, the results of confirmatory factor analysis confirm reliability and validity of scale construct. The goodness of fit values is at an acceptable level in the path analysis. According to the results, statistically significant relationship is only confirmed between E and BI and between A and BI. The findings suggest that individuals make their online grocery because of enjoyment and positive attitudes. Based on these results, it is plausible design online grocery shopping as a fun and an enjoyable experience.

Exploring Public Attitudes Towards Meat Policies in Europe

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Governments worldwide are increasingly exploring policies aimed at promoting healthier and more sustainable dietary choices. Drawing from existing literature on the efficacy of fiscal policies in shaping food consumption behaviours, particularly concerning meat consumption, this study delves into public attitudes toward two potential interventions: the introduction of a meat tax and the discontinuation of meat subsidies. Using data from a survey conducted across various European countries, we employ Partial Proportional Odds models to analyze factors influencing attitudes toward these policies. Our findings reveal nuanced insights into the determinants of public support or opposition, highlighting the role of socio-economic, demographic, and attitudinal factors. Notably, while income and unemployment were found to have no significant impact, cross-country variations were evident, with Spain, Portugal, and the UK exhibiting higher odds of supporting the meat tax than the Czech Republic. Education and gender did not emerge as significant predictors, while age played a notable role, indicating a decreasing likelihood of support for both policies among older individuals. Moreover, environmental attitudes and egoistic tendencies were associated with increased odds of support, while security concerns and hedonic values decreased the likelihood of support. Our study underscores the complexity of public attitudes toward meat policies and provides valuable insights for policymakers seeking to design effective strategies to promote healthier and more sustainable dietary behaviours in the EU.

Employing structural equation modelling to measure resilience of farms. Framework and concept

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Current agricultural systems face many challenges, problems, risks. This requires finding complex solutions to increase their resilience and reduce their vulnerability to internal (at farm level) and external (macroeconomic) factors, including economic, environmental, institutional and social. For this reason, building and strengthening resilience of whole agricultural system, subsystems, different sectors or even farms is extremely important during crises, for long-term and for whole economy. Structural equation modelling (SEM) is a comprehensive method to analyse complex phenomena within many fields of science as it combines numerous advantages of analysis of variance, regression, factor analysis and path analysis, and extends them with the possibility of modelling cause-and-effect relationships using latent variables. SEM was already employed to investigate various types of resilience among others in psychology, medicine, well-being and other areas of social sciences. Obviously SEM has been used many times in agricultural economics as well as environmental economics and sustainability. However, so far this technique has been used very rarely to study the resilience of farms. Therefore, this methodical study aims to explore the possibilities to apply the structural equation modelling to assess resilience of family farms. For the research a group of 200 small-scale farms in Poland (up to 20 ha of UAA and standard output up to EUR 50 thousand) was selected. This research is grounded in resilience theory and framework with three resilience capacities: robustness, adaptability and transformability. A farm to be resilient in short and long-term should implement all these three strategies, however, practically it is very complicated and demanding task. Therefore, there is a question – can farms adopt all these three strategies at the same time or are they contradictory? The analysis reveals a synergy between these strategies in the analysed group. It means, farms are, at the same time, able to survive despite perturbations (robustness), adapt do changes, restructure and transform in order to be viable under new circumstances. The preliminary results prove stronger relationship between adaptability and transformability (which requires more time) in comparison to their connections to robustness, which is associated with stability in short period.

The role of policy in the use of Crop Wild Relatives and the enhancement of agrobiodiversity in Europe

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Due to growing market pressures and the industrialisation of food production since the 1900s, farmers have abandoned local crop varieties in favour of high-yielding, genetically uniform species, leading to significant plant genetic erosion worldwide. The loss of diversity at the crop, variety, and genomic level threatens the resilience, productivity, and adaptive capacity of agroecological systems and poses a major threat to food and nutrition security. Therefore, enhancing agrobiodiversity and adapting to changing climatic conditions in farming has become a policy priority in Europe. Improving the genetic make-up of our common crops through the adoption of genes from wild plants is one possible way to do this, and it is increasingly being explored by European research and policy institutes. These wild plants, also known as crop wild relatives (CWRs), are the progenitors or wild cousins of commonly cultivated crops, which have played a significant role in plant domestication and crop improvement for millennia. They thrive in diverse habitats and are a rich reservoir of valuable traits, making them an ideal candidate for enhancing the resilience of current agricultural systems. Through an interpretive policy analysis, this presentation examines how local and European policies and management regimes safeguard and affect the use of CWRs and the overall maintenance of agrobiodiversity in Europe. We look behind the currently available policy thinking and assess what benefits farmers and breeders gain from the present governance of CWRs. Policy is frequently called upon both by business and civil society to create the conditions for a sustainability transition in farming. This presentation examines what role policy could play in this context and where its potential limits lie.

Assessing the Impact of Marine Protected Areas on Fisheries Resources: An Empirical Analysis Based on the Pressure-State-Response Framework

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The marine environment, accessible to humans, loses its value due to development and self-interested fishing. Overfishing harms the environment and fish stocks, reducing valuable species. This issue is central to illegal, unregulated, and unreported (IUU) fishing, which global society aims to eliminate. Marine Protected Areas (MPAs) are tools to mitigate human impact and sustain fisheries by maintaining fish stocks and enhancing biodiversity. MPA coverage has risen due to countries' commitments to designate 10% of their marine areas as MPAs by 2020 under the Aichi Target 11 of the Convention on Biological Diversity, and Goal 14 of the UN Sustainable Development Goals. Currently, MPAs cover about 8.2% of the global marine area, with significant contributions from countries like the U.S., France, and Australia. The link between fisheries resources and MPAs is clear. Environmental policies within the Pressure-State-Response (PSR) framework by the OECD influence fish stock quality and quantity. MPAs aim to benefit the sustainability of fisheries resources, but some argue that poor MPA planning can worsen conditions, increasing fishing intensity in adjacent areas. Studies show mixed results on the effectiveness of MPAs in recovering biodiversity and resource abundance. Differences in MPA management, data limitations, and external factors complicate robust empirical evidence. This study analyzes data from 114 countries (1996-2021) from OECD, FAO, and Yale's database to examine the relationship between fish stock indicators, MPA proportions, and catches. Additionally, the study investigates the role of Official Development Assistance (ODA) in MPA expansion in developing countries. Specific ODA for expanding MPAs is crucial for biodiversity conservation and is a significant funding source for many low-income countries. Proper ODA allocation could be key to effective MPA implementation. Our findings suggest that inadequate MPA planning or fisheries management hinders fish resource conservation. Thus, MPA presence alone may not indicate sustainability. This highlights the explicit need for setting total allowable catch (TAC) limits as a long-term fisheries management strategy. As a result, this study contributes to understanding the relationship between fisheries resources and MPAs based on empirical evidence. It highlights the need for effective MPA planning and management to conserve the marine environment sustainably.

Sustainable Aquaculture: Challenges and Barriers to the Growth of the Aquaponics Sector

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Aquaponics, a technology combining plant and fish production in a circular system, is promoted by the European Union as a solution for sustainable food production. It offers several advantages over conventional agriculture and aquaculture, such as reduced use of fertilizers and pesticides, more efficient water usage, and less environmental pollution. However, the success of aquaponics businesses hinges on effectively managing production intricacies and securing competitive market prices. Despite growing research interest, European aquaponics farms remain scarce, encountering hurdles like substantial investment requirements, market competition, and complexities in marketing diverse product ranges. Therefore, the aim of the current study is to close the knowledge gap by researching existing and planned aquaponics farms and conducting expert interviews to identify success factors and obstacles in marketing aquaponics products, ultimately providing recommendations to promote these products. To understand the success factors in marketing aquaponics products, the project conducted 10 expert interviews with sector stakeholders. After contacting 12 relevant companies across Germany and Europe, seven agreed to participate. Additionally, five experts from academia and food retail were included. Interviews took place from October 2023 to February 2024. The interviews were audio-recorded, transcribed and analyzed using qualitative content analysis. Categories were initially deduced from literature and further developed inductively, using NVivo software for coding. The initial findings highlight key success factors for marketing aquaponics products, emphasizing the appeal of sustainable, locally-produced food. However, success in production and marketing requires diverse skills, including financing, construction, and operation. Two primary approaches emerged: trial and error with continuous adjustment, and adapting proven models to local conditions to reduce failure risks. Business models were categorized into cost leadership, direct marketing, and integration into broader social frameworks. Challenges, especially in trial-and-error processes, were noted, exacerbated by unforeseen events like the Ukraine crisis, complicating definitive profitability assessments based solely on expert input.

Exploring the potential and challenges of underutilised crops in agri-food value chains: an example of Lathyrus in Germany and Spain

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Modern agri-food systems pose multiple requirements towards the crops introduced into the value chains. These crops must be adjusted to a changing climate, meet societal expectations for environmental sustainability, be attractive to consumers and enrich their diets. In this article we explore the potential and challenges of underutilised crops and varieties in agri-food value chains. We study the example of Lathyrus species – an underutilised legume genus that is rare in Germany and occurs more often in Spain. Our specific objectives are: - to investigate the experiences related to production and processing of Lathyrus species in the context of Germany and Spain; - to analyse the potential and main challenges of Lathyrus in agri-food value chains. We combine the results of the literature review with the information on Lathyrus farming practices collected during a qualitative interview with a German farmer and from farm records of a Lathyrus farm in Spain. The information on processing methods and crop use is based on the literature review. The study shows that Lathyrus has the potential to meet a number of societal demands. For example, Lathyrus is adapted to dry climates and tolerates high rainfall, making it an interesting crop for German farmers. As a nitrogen fixing crop, Lathyrus can play an important role in multiple crop rotations, reducing the need for fertilisation and providing an attractive alternative for organic farmers. The constraints for Lathyrus species were analysed at different levels of the value chain. For example, the main production challenges include lack of information on cultivation techniques suitable for German conditions - the choice of companion crop in mixed cultivation and harvesting difficulties due to uneven ripening. Processing challenges include the pre-processing stage and the cleaning of the harvest in the case of mixed cropping, and the choice of appropriate processing methods to reduce the levels of toxins found only in the raw material of this crop, thereby improving the nutritional content and making it suitable for human consumption. Lack of quality standards for Lathyrus in Germany is another important challenge for the entire value chain. Based on the BioValue project www.biovlue-project.eu.

Setting carbon tax on Finnish regional and national dairy production – SEEA-based multiplier analysis

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Dairy production is key production line to Finnish agriculture. Environmental and climate concerns have raised critical voices, since methane and nitrous oxide emissions are prominent and manure spreading causes nutrient leakages. Recently, for example ESABCC (2024) has suggested that in order to mitigate the climate impacts of agriculture, emission pricing should be extended to agricultural production. The aim of the study is to analyse the economic and environmental impacts of carbon tax imposed on agriculture and on dairy exports based on their climate emissions. The study combines System of Environmental-Economic Accounting for Agriculture, Forestry and Fisheries, SEEA AFF (FAO & UN 2020) with social accounting matrix (SAM). SEEA AFF combines monetary and physical production and its environmental and climate effects, while SAM provides linkages to other industries, households, government and the rest of the world. SEEA –Central Framework follows System of National Accounts (SNA) principles providing consistent monetary calculation. Six different scenarios are conducted with the SAM multiplier model. Scenario 1 sets carbon tax of 25 EUR/t CO₂ equivalents on agricultural industry and Scenario 2 sets carbon tax of 80 EUR, correspondingly. In Scenarios 3 and 4, agricultural households are compensated with equivalent income transfers. Scenarios 5 and 6 set carbon tax on the dairy exports. The relative (negative) impacts on agricultural industries, in terms of agricultural outputs, household incomes and agricultural capital incomes, were prominent in comparison with the attained emission reductions. In addition, reductions in dairy production have knock on effect especially on food manufacturing. On the one hand, reductions in cattle numbers and thus animal manure, fertilizers and plant protectants would decrease emissions. However, the cultivated landscapes and fallows would disappear if the released land areas are completely out of agricultural uses, for example forestry or settlements. References: European Scientific Advisory Board on Climate Change. 2024. Towards EU climate neutrality. Progress, policy gaps and opportunities, Assessment report 2024, Luxembourg: Publications Office of the European Union. Food and Agriculture Organization of the United Nations and United Nations. (2020). System of Environmental-Economic Accounting for Agriculture, Forestry and Fisheries (SEEA AFF). Rome.

EU CBAM's Role in Achieving Green Deal Targets and Its Impact on the EU Agricultural Sector

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Introduction: Given the EU's commitment to reduce GHG emissions by 55% by 2030 and 90% by 2040 from 1990 levels, and the lack of ambition in non-EU countries, there is a risk of emission leakage. To address this and maintain the competitiveness of EU producers, the EU introduced the CBAM. This mechanism assigns a carbon price to emissions in imported goods, ensuring parity with domestic production. The CBAM, fully implemented from 2026, covers sectors under the EU-ETS and susceptible to leakage, such as cement, iron and steel, aluminum, nitrogen fertilizers, electricity, and hydrogen. **Objectives:** This study aims to evaluate the EU CBAM's contribution to the Green Deal targets, focusing on agriculture and regional effects at the NUTS2 level, using the CAPRI model. The MAGNET model examines the EU CBAM's impact on trade and its role in reducing leakage. The EU agricultural sector will be primarily affected through fertilizer markets included in the CBAM, as agricultural commodities are not regulated under EU-ETS and CBAM. **Research Questions:** 1. How does CBAM contribute in reaching the GD targets and affect the EU agricultural production? 2. How does the adopted CBAM affect emission leakage and EU farmers' competitiveness? **Theoretical Framework** The linkage starts with simulating the EU CBAM in MAGNET. From MAGNET to CAPRI, the connection is through fertilizer prices and input use in the EU. CAPRI feeds back to MAGNET with changes in agricultural production, land use, and technological mitigation impacts. **Methodology:** A global-to-local-to-global framework links MAGNET (multi-regional, multisectoral, CGE) and CAPRI (global, comparative static PE model for EU agriculture). CAPRI includes a nutrient flow model and accounts for GHG mitigation technologies. Effects are analyzed for 2030 and 2040. **Main Expected Results:** The main expected results are the evaluation of the role of EU CBAM in reaching the GD targets, specifically its impact on nutrient loads and the adoption of GHG mitigation measures in the agricultural sector. Additionally, the impacts on agricultural production, land use at the regional level, as well as leakage and trade, will be analyzed.

Turning food waste and agri-food byproducts into animal feed ingredients and organic fertilizer using insects – Towards pilot implementation in Greece

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Our food system is dysfunctional: While 10% of human population is undernourished, we feed food-grade materials to livestock and waste 1 billion tons of food every year. Insects can help us break this resource-intensive pattern: Certain insect species can be mass-reared on food waste and agrifood byproducts to be processed into animal feed ingredients, while leftover frass is an organic fertilizer. Implementing this circular technology in Greece can: Save large amounts of food waste from the country's landfills, reducing GHG emissions. Bring income to domestic agrifood businesses by valorizing their byproducts. Reduce dependence of national fish and livestock farming sectors on imported, price-unstable feed ingredients with heavy environmental burden. Reduce dependence of Greek agriculture on mineral fertilizers, manufactured energy-intensively from imported non-renewables. Despite these environmental and socioeconomic benefits, the technology is not yet applied at any commercially relevant scale in Greece. Critically, lack of a pilot implementation limits technological and regulatory knowhow, access to finance as well as general awareness and acceptance in the country. As a cross-sector consortium we aim to overcome these obstacles: We will adapt the technology to Greece, with focus on: Bioclimatic facility design for minimal energy footprint. o Optimal insect rearing diets combining local food waste and agrifood byproducts for minimal input costs and maximal resource-efficiency. We will setup a pilot facility in Chania/ Crete to: o Assess technological and environmental performance. o Characterize the quality and safety of the produced animal feed ingredients and organic fertilizer, including trials with local end-users. o Acquire commercial license from regional and national authorities, thus unveiling a regulatory pathway in Greece. We will make a case for "insect business" in the country by: Showcasing the facility to create technology awareness and acceptance. Presenting business cases to encourage technology uptake and investment. Providing technical and regulatory guidelines to prospective insect businesses. Promoting insect products in the domestic markets. With this stepwise strategy, we expect to create a hub of technical, regulatory and business knowhow in Greece, which will aid the establishment of a lively domestic insect sector on par with the rest of Europe.

Heterogeneous potential of farms to adopt organic agriculture: The case of German dairy and arable farms

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The study analyses the adoption of organic farming (OF) in relation to the farm structural characteristics and the local farming and market conditions. Its objective is to identify the heterogeneous potential of German farms to adopt OF given their current structural characteristics and neighbourhood conditions. Specifically, we aim to analyze how farm structural and neighborhood factors affect farms' decision to convert to organic farming (OF) and whether there are systematic differences in OF adoption between farm types, with the goal of uncovering potential conversion patterns. To conceptually underpin the economic rationale of the OF adoption decision, we build on the utility maximisation principle. We decompose the expected utility (EU) into its core cost-benefit components — expected conversion and opportunity costs, production and market risks and non-monetary benefits. We link the observable farm structural and neighbourhood factors to the latent EU components to better understand the core barriers to OF adoption. Empirically, we estimate two logistic regression models using data from the German Agricultural Census – for the conversion decision between 2010 and 2016 and between 2016 and 2020. Structural characteristics that reduce production risk (e.g., farms with diversified crop structure) and lower conversion and opportunity costs related to factors, such as closed farming systems prior to conversion, lower sunk costs or additional investment needs, have a positive effect on the probability of conversion to OF. Systematic differences in the role of structural factors were found for the conversion of dairy and arable farms, though this varies spatially. Also, a well-established local organic sector that allows for synergies with neighboring farms is found critical for reducing conversion-related risks and transaction costs. Proximity to processors of organic produce or on-farm marketing increase probability of conversion by mitigating marketing costs and risks. Differences between periods suggest that market risk has become a more critical factor in more recent years.

Exit or Reversion? Structural Specifics of German Farms Leaving Organic Farming

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The number of farms adopting organic farming (OF) is increasing in Europe, though the adoption rate lags behind EU policy targets. While most studies focus on factors driving conversion to OF, few investigate its durability. This study aims to determine the specifics of organic farms that exit agriculture or revert to conventional farming (CF), addressing whether organic farms are more or less likely to exit than conventional ones and under what conditions. It also explores the specifics of organic farms reverting to CF and what might explain the different farming transitions and facilitate the OF persistence. Guided by lifecycle theory of the firm, resource-based view, and the push-pull-mooring model, we analyze data from the German Agricultural Census for 2010, 2016, and 2020, categorizing farms by their "life" trajectories (persistent, exits, new/start-ups) and farming practices (transition). We compare organic farms on exit and reversion trajectories with their counterparts using ANOVA or Dunn's test and analyze structural factors of exit and reversion paths through multinomial logistic regression. OF shows a lower annual exit rate than CF (1.6% vs. 2.7%), with 2% of organic farms reverting to CF. Farms that exit farming generally have smaller utilized agricultural area (UAA), with exiting organic farms being larger than conventional ones, suggesting that OF requires more land for economic viability. Decreases in UAA are observed prior to exiting and reverting, regardless of the farming practice. Exiting organic farms are located in areas with on average higher land use concentration, indicating vulnerability to local farmland competition. Reversion to CF occurs as a short-term survival strategy for farmers nearing retirement. Higher livestock density and permanent grassland contribute to OF durability. These findings highlight the need to enhance the economic viability of organic farms to withstand local competitive pressures and increase their overall resilience.

Breeding Livestock: An Intensifier of Climate Change or a Mitigation Strategy?

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Livestock production is essential for sustainable food security and global demand for livestock products is still increasing. However, livestock contributes to climate change through greenhouse gas (GHG) emissions and climate change in turn is a major threat to global food security. Novel breeding technologies provide the potential of transformative changes in livestock production. Livestock models have investigated the role of novel breeding technologies on mitigating climate change. However, the impact of novel technologies on global food consumption, land use and economy are currently less well explored. Systems models can fill this gap but need to incorporate transformative changes to livestock production. This study aims to demonstrate the importance of integrating livestock models into systems models to assess the global impacts of novel breeding technologies as a mitigation strategy for climate change. This study uses the computable general equilibrium (CGE) model MAGNET to predict outputs for 2050 under two scenarios using input drivers from livestock models. The first scenario models the status quo of climate change and livestock production. The second scenario then incorporates the impact of novel breeding technologies. Temperate-humidity index (THI) projections were obtained for SSP2 using an available climate projection model. The negative impact of climate change was calculated by THI changes and the drop in livestock production and feed conversion ratio. Technology improvements were obtained from FAO historical data and adjusted for new methodologies. The results show that while in climate change scenario, the land-use and GHG emissions at EU level increase by 0.3% and 0.8% accompanied by a reduction in food affordability and caloric supply. In scenario with novel breeding technologies, the negative environmental and food security impacts due to climate change are avoided. Our modelling results indicate that breeding technologies can offset the detrimental effects of increased livestock production to global warming.

Reputation Indicator Mapping for German Wine Regions

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We derive a reputation map for wine regions in Germany using consumer rather than expert quality ratings. Consumer ratings of wine quality on online platforms such as Vivino have grown significantly in recent years. European Union policy grants that wines from a protected regions or geographical indications (GI) have specific qualities and a collective reputation tied to their production area. Studies on wine reputation have concentrated on past quality as individual product or firm reputation measures and on average quality of producer groups for collective reputation indicators including wine GIs (e.g. Landon and Smith, 1997; Schamel, 2009). We analyze a large sample of consumer ratings for German wines currently available in Germany with information on producer/brand name, wine type, name and vintage, the average quality rating, and the number of consumer ratings (min. 25) for each vintage, the price per bottle reported on Vivino at the time of data collection, as well as its regional origin or GI. We also obtain structural information including hectoliters or volume of production and hectares under vines to characterize the supply chain structure for German wine regions. Using the data, we develop a reputation indicator map for German wine regions and compare their relative position based on 3 dimensions: (1) average user rating describing perceived collective quality, (2) average prices indicating the market's current evaluation for a region's wines, (3) the number of ratings for GI wines relative to the total number of ratings for Germany expressing the popularity among users. An alternative measure for the third dimension is the relative size of a wine region or GI based on production volumes. We group results by price range, wine type (white or red wine) and producer type. A general positive relationship emerges between average prices and perceived collective quality ratings while some smaller wine regions remain almost unknown among Vivino users. Wines from the Mosel and Ahr Valleys, as well as the Rheingau rank as leading GIs in terms of perceived collective quality and popularity. The results are compared on an international scale with wine regions from Italy and Spain.

An Integrated Approach to Linking Sectoral Models and Individual Dietary Behavior

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Research questions: Diet transformation is essential for health and environmental sustainability. It remains unclear which changes are easiest for consumers to adopt and what political interventions should focus on to support change efficiently. Economic models usually depict raw primary commodities (RPC) for human consumption but do not capture details on the value chain to food product intake, making them unsuitable for assessing health implications. Objective: To link individual health with the sectoral and environmental level, we connect different data sources and create a tool that translates market balance quantities into food product intake. This allows for a detailed understanding of diet transformation options and their environmental and health implications. Method and theoretical framework: We consider datasets on 1) RPC quantities for human consumption from the market balance, 2) meat partitioning, 3) processing, 4) recipes, 5) non-avoidable waste, 6) avoidable waste, 7) intake of food products from the German National Nutrition Survey II. They are consolidated into a consistent quantity flow by minimizing deviations between original and estimated data within logical conditions. The resulting dataset allows for simulating shocks on the market balance quantities, intake of RPC and food products. Preliminary results: We confirm that food intake surveys suffer from underreporting of energy intake and overreporting of fruit and vegetables. We find potential biases in the recipe data regarding substituting expensive ingredients with cheaper alternatives (olive oil by other oil, beef by pork). Food-based dietary guidelines can be misleading when they do not consider misreporting in status quo intake data and indirect consumption of, e.g., oils and sugar via composite products. Accounting for both, we find that the extent and direction of the recommended dietary changes often differ significantly. Using previous simulations of the Planetary Health Diet (PHD) in a sectoral model (CAPRI) by shocking market balance quantities, we find that the recommended per capita intake of RPC and, therefore, the PHD's health objective is not met. Our tool calculates respective shocks for future, more accurate CAPRI simulations. We find how consumers can adjust their intake of food products to accommodate for the PHD with the least overall adjustment effort.

Total Factor Productivity in EU Livestock Farming: Balancing Sustainability and Competitiveness

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The livestock sector undeniably impacts the environment negatively, contributing to greenhouse gas emissions and water pollution. To mitigate these effects, livestock farming systems need to shift towards more sustainable practices. In the European Union, several policy directives, such as the Green Deal, Farm-to-Fork strategy, and Nitrate and Water directives, aim to enhance environmental sustainability in agriculture. These policies seek to improve livestock farming, animal health, and welfare while promoting environmental sustainability. However, implementing these changes poses challenges, including increased production costs and the need for efficient resource management, all while maintaining profitability and competitiveness. Extensive farming systems in the EU, which rely on permanent grasslands, pastures, and meadows, help mitigate greenhouse gas emissions from livestock, reduce dependency on feed concentrates, and provide employment in marginalized rural areas. Additionally, these systems offer ecosystem services like landscape maintenance and promote biodiversity. Despite these benefits, it remains uncertain whether extensive farming systems can compete with intensive feed and forage-based systems that use feed concentrate or arable land for fodder crop production. This study aims to address two main objectives. First, using stochastic frontier analysis, it examines the total factor productivity (TFP) of extensive and intensive grazing livestock systems across the EU, breaking down TFP changes into components: technological change, technical efficiency change, and scale effects. Expected results anticipate higher TFP in extensive systems due to lower input use, while intensive systems may yield greater output at the expense of resource constraints and environmental impacts. Second, it analyzes the effects of the CAP subsidies on TFP changes. Utilizing an unbalanced panel of specialist dairy and other grazing livestock farms from the EU FADN data from 2007-2017, this study aims to provide valuable insights for promoting efficiency and productivity within the EU livestock sector.

Analysis of Sustainable Agri-Food Systems: Assessment and Comparison of Sustainability Indicators

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Agri-food systems encompass an intricate array of economic, social, political, and environmental activities that enable the production of food. These activities are carried out through a continuous series of interactions, both direct and indirect, among the different actors involved in the agri-food chain. Recently, there has been a significant focus on identifying and implementing sustainable agri-food systems. However, there are challenges in getting primary producers to adopt these systems and in convincing consumers of their value. This study conducted a preliminary selection of 20 SAFA indicators, with five indicators allocated to each of the four pillars of sustainability: economic, social, environmental, and governance. The comparison of these indicators was conducted according to the guidelines of AHP. This comparative study of priority and importance was applied to two different food systems: short food distribution channels (Direct and proximity sales), and food quality scheme (Geographical Indications), both in Spain. The findings from both agri-food systems demonstrate a significant dominance of economic indicators, while the other aspects exhibit behaviours that are influenced by the unique characteristics of each system. Regarding environmental indicators, the promotion and conservation of local varieties emerge as a pivotal element in both systems. The conducted comparative analysis shows evidence of the agents' dedication to preserving the environment and addressing current climate requirements. Additionally, there is a concerted endeavour to uphold stable governance systems and make meaningful contributions to social development. However, the successful execution of these enhancements relies heavily on attaining economic viability. This paper presents a comprehensive perspective on the significance of maintaining a balance among the various aspects of sustainability in agri-food systems. It emphasises the necessity of holistic approaches that incorporate economic, social, environmental, and governance factors in order to attain genuine sustainable development.

High resolution climate variables under climate change conditions for European Countries – the BioValue pilot site areas

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Climate change significantly affects the growing conditions and key physiological processes of the most important staple crops in both human and animal food chains. This potential threat could undermine sustainable global yield growth and biodiversity in the agri-food value chain, due to the anticipated impacts of climate extremes like heat stress and droughts. In response, the BioValue project aims to develop a dynamic and modular agent-based simulation tool to analyze the links between biodiversity, the agr-food value chain, the environment, consumer preferences, and health. To investigate the interaction between climate change and biodiversity in the BioValue pilot site areas, high-quality climate projections for the next decades at daily scale and 1 arcmin spatial resolution for variables of interest, such as temperature and precipitation, are carried out using statistical downscaling and bias correction approaches. Three high-resolution CMIP6 model simulations under the climate change scenario SSP5-8.5, encompassing all global warming levels, have been post-processed. For the statistical downscaling, the Perfect Prognosis approach is employed, based on the analysis of the relationship between the synoptic scale atmospheric circulation and the regional weather. This is achieved by statistically linking the large-scale predictors to the local scale predictands. The developed model is then applied to the global climate models outputs to downscale the local scale variables. Delta-Quantile mapping is a common and powerful method for correcting biases in climate model simulations. The method entails fitting the cumulative distribution function of the model output to that of the observed data, thereby eliminating systematic biases in the simulations. The final products demonstrate satisfactory to very good agreement with observational data following the two applications. However, model uncertainty still dominates in regions with complex terrain, resulting in differing error patterns depending on the pilot site area.

The adoption of environmental labelling in the EU food supply chains: a systematic review

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The global food system significantly impacts the environment, with all supply chain stages contributing. Policymakers are increasingly addressing these environmental concerns while ensuring food security and nutrition for a growing global population. Understanding the environmental impact of food supply chains is crucial for farmers, agri-food industries, and consumers to mitigate these impacts. The European Union promotes sustainability and environmental responsibility through initiatives like the EU Green Deal and Farm to Fork strategy, which emphasise transparent labelling. Labelling aims to inform consumers about products' environmental and social impacts, enabling sustainable and healthier food choices. Sustainability labelling is gaining interest among academic, public, and industry sectors, with numerous initiatives worldwide. These labels are crucial for promoting sustainable practices by providing clear product information and helping consumers make informed choices. However, consumer awareness and use of sustainability labels remain low. Recent literature reviews primarily focus on consumers' understanding and perception of these labels, with fewer studies examining the supply-side perspective. This systematic literature review aims to identify the primary factors influencing the adoption of sustainability labels in EU food supply chains. It explores key drivers and barriers, offering insights to policymakers to integrate and improve sustainability labelling effectively in EU food supply chains. Two databases (Scopus and Web of Science) were systematically searched for studies examining drivers and barriers to adopting environmental labels. The screening process followed PRISMA guidelines. The initial pool consisted of 1515 studies; after applying exclusion criteria, 19 articles were selected. Preliminary results indicate that key drivers for adopting sustainability labels in EU food supply chains include innovation opportunities and market differentiation. In contrast, barriers include the complex regulatory landscape and high certification costs.

Recording EU society's awareness of climate change, food security, and biodiversity towards a more resilience agro-food system

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Food security and climate change are among the most critical challenges of today, while biodiversity considered as the foundation of human life and prosperity, ensuring climate protection and food security. As the planet experiences shifting and extreme weather patterns, the ability to produce and access an adequate supply of nutritious food for a growing population becomes increasingly uncertain and challenging. In recent decades, policymakers have been making significant efforts to halt and reverse the biodiversity loss and mitigate the adverse impacts of climate change and food insecurity. Apart from the design of strategies and measures concerning food production, the environment, and the economy, another equally important factor that must be taken into serious consideration is the participation and role of all stakeholders in the food system. A Delphi study approach was undertaken, informed by desk research, engaging participants from four groups: Policymakers at local, regional, and European levels; end-to-end supply chain practitioners (i.e., farmers, food processors, wholesalers, and retailers); Civil Society organizations (NGOs, associations, etc.); and consumers, covering all biogeographical regions of Europe. This diverse group of participants was critical in capturing a comprehensive set of needs, challenges, and trends within their respective industries, resulting in a rich tapestry of insights. The Delphi study employed a SWOT analysis format, seeking experts' opinions on critical Strengths and Weaknesses describing the current situation, and also Opportunities and Threats regarding the potentials/future. The results indicated that a notable proportion of participants are aware of the situation and the risks affecting or influences by the food system, providing useful information about society's consciousness of climate change, food security, and biodiversity. Factors considered to have the most significant negative impacts were highlighted, as well as those that could contribute to addressing these challenges and strengthening the food system. However, the exploration of disparities among the segments within the SWOT matrix and behavior-related statements underscores the intricate nature and importance of human dynamics and consumer conduct. Acknowledgement This study is based on research undertaken by the ECOREADY project, which was funded by the European Union Horizon Europe Research and Innovation Programme under grand agreement no 10108420.

Societal perceptions and attitudes towards genetically modified (GM) crops, feed, and food products in the Middle East, North Africa, and Turkey (MENAT) region: A systematic literature review

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Modern biotechnology and associated genetic modification techniques can help tackle several global challenges including, inter alia, climate change and food security. However, there is a great deal of global controversy regarding the prudence of their application in food production. Hence, societal acceptance of GM crops and foods is crucial for their proliferation and commercialisation to be successful. In response to an evidenced lack of research on attitudes towards GM foods in emerging economies and developing countries, and following a systematic approach with a thematic analysis tool, this review compiled current knowledge and available evidence on perceptions and attitudes towards GM crops and foods in the MENAT region to support existing and future research and identify existent knowledge gaps. The findings revealed that people in the MENAT region hold a mixture of positive and negative attitudes towards GM foods and crops, with negative attitudes predominating, and also exhibited poor levels of knowledge about GM foods and their local existence. Overall, plant-based GM products were, notably, more acceptable than the application of genetic modification on animals for food production. The results also demonstrated the importance of risk and benefit perception, GM knowledge and educational background, and cultural and moral beliefs in the formation of attitudes towards GM foods and crops. In conclusion, social research of GM application in food and agriculture sectors in the MENAT region is still in its early stages and future and more targeted research in this area is highly encouraged.

The role of scientific data in shaping EU policies: enhancing food security resilience in the context of biodiversity loss and climate change: a systematic analysis and scoping group engagement with policy actors

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The impact of climate change and environmental degradation has put food systems worldwide under growing pressure. It is essential to identify the discrepancies between the present condition and the ideal future state of food security, while considering the factors that influence the resilience of these systems. In the framework of ECO-READY project, we aimed to critically investigate whether the current policies are properly reflecting a vision for Food Security (FS) resilience. For this purpose, a systematic EU policies review was carried out for linking scientific data related to Climate change (CC), Biodiversity (BD), and Food Security (FS) to European Commission (EC) policy frameworks. Two Eclipse synthesis methods, Expert Consultation and Systematic Map, were considered, using CC, BD, and FS as main keywords and "environment", "water", "energy", "health", "economic", and "society" as secondary keywords. The assessment of the relevant EU policies and the identification of gaps between data and policy was carried out by selecting and using a list of keywords related to the main indicators and drivers of CC, BD, and FS. Through the establishment of a scoping group activity, the findings provided input for engaging external European policy actors qualitatively and for integrating their feedback. The integration of scientific data into current EU policies aimed at addressing environmental challenges varies in effectiveness. Challenges persist regarding coherence and accessibility. Policies should support the adoption of sustainable agricultural practices and emerging technologies while considering economic and social implications, especially for small farmers and rural communities. Future directions include robust data for developing scenario models and remote sensing and ICT technologies (IoT, AI) for real-time monitoring across all the farm-to-fork value chain. Effective dialogue with policy actors, particularly from the scientific community, is crucial to achieving these objectives.

Certification of novel food commodities based on DNA barcoding: a BIOVALUEable proof-of-concept

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Nowadays, neglected and minor crops are increasingly recognized for their nutritional value and role in biodiversity protection and sustainability. Under that prism, consumers' demand has been the driving force behind formulating novel foods that incorporate high-quality crops. Many of these commodities are constituted by mixtures of crops. At the same time, advances in food science and technology allow their usage as flour to generate non-typical popular food (i.e., non-wheat pasta). The Biovalue project, a research initiative focused on developing and certifying such novel food commodities, aligns with the aforementioned principles and follows a farm-to-fork outline. An integral part of the food sector and the Biovalue project is accreditation. Therefore, it is necessary to accurately characterize and attest products based on heirloom varieties/minor crops and prevent adulteration, which affects product quality. In that sense, a certification scheme utilizing DNA barcoding to distinguish and identify species used is essential. A proof-of-concept based on Biovalue products was piloted to develop tailor-made protocols for discrete commodities. Products of different processing levels (raw, concentrated, sundried, steamed, boiled) were used to optimize DNA extraction and the capacity to amplify DNA markers (ITS and rbcI) from food mixtures. Using commercial kits and standard protocols, it was established that a modified CTAB extraction protocol yielded the best results. Furthermore, it was proven that the boiling of products had a detrimental effect on DNA extraction, making a barcoding certification scheme not possible. Nonetheless, DNA from several commercial products (legumes mixes, lentils pasta, fusilli, frozen lentils mix, canned crop mix) was successfully isolated, and amplification resulted in specific ITS and rbcI biomarkers. Next-generation sequencing (NGS) analysis of the amplicons successfully established the ingredients (at the genus and species level) and their ratio in each product. ITS and rbcI markers had equal analytical power, showing that fine discrimination can be achieved equally by using nuclear or chloroplastic DNA. Moreover, species were identified that were not referred in the food label, proving the versatility of the certification scheme.

The Role of Soil Microbiological Indicators in Enhancing Agricultural Sustainability and Climate Resilience

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As global food security faces increasing threats from climate change, effective soil management becomes essential to sustain agricultural productivity. This study focuses on the critical role of microbiological soil indicators—microbial biomass, enzymatic activity, and microbial community diversity—in monitoring and improving soil health for agricultural sustainability. The primary objective is to examine how these indicators can serve as tools for enhancing food security through improved soil management practices. The research questions centre on how microbiological indicators can be optimally utilized to assess soil health and their direct implications for agricultural output and food security. The theoretical framework is grounded in the ecosystem services approach, which posits that healthy soil microbial ecosystems contribute to increased crop yields and sustainable food production systems. The methodology incorporates a mixed-methods approach, combining advanced bibliometric analysis with empirical field studies across varied agricultural landscapes. This approach facilitates a comprehensive review of the literature and detailed soil health assessments, enabling an integrated analysis of the effectiveness of microbiological indicators in soil health monitoring. Expected results aim to establish a robust link between effective microbial activity in soils and increased agricultural productivity, thereby enhancing food security. The study is intended to provide strong empirical support for incorporating microbiological indicators into soil management policies, suggesting that such integration can substantially improve the resilience of food production systems against the backdrop of climate change. Furthermore, by elucidating the connections between microbiological research and policy applications, the study anticipates offering actionable insights into how targeted soil management strategies can bolster food security. This could guide the implementation of the European Union's "Soil Monitoring Law" and promote the adoption of standardized, scientifically validated practices for soil health monitoring across member states, ultimately supporting more robust and resilient food systems.

Policy Experiments via Digital Data Processing: Leveraging Data Warehousing and Bayesian Networks for Agricultural Price Prediction

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According to Statista, we generate more than 328 billion gigabytes of data per day [1]. A significant portion of this daily creation is agricultural data. Internet of Things devices, sensors, weather stations, robotic farm equipment, agribusinesses, and markets produce vast amounts of information relevant to various agricultural domains. These datasets are complex, large, structured, unstructured, or semi-structured, often inconsistent, error-prone, flawed, and difficult to manage. Therefore, techniques, tools, and practices from Big Data analytics can be leveraged to derive meaningful insights that enhance decision-making. The objective of this paper is to explore the impact of different policy scenarios on commodity prices using a Data Warehouse (DWH) and Bayesian Networks. The DWH integrates extensive historical datasets from diverse sources, including commodity prices, weather patterns, crop yields, market trends, and policy scenarios. Big Data tools such as Hadoop HDFS, Hive, Sqoop, and Spark facilitate fast access to these large datasets and enable the execution of high-demand operations. Bayesian Network models developed and trained using this integrated data incorporate key variables such as historical prices, weather conditions, input costs, and economic indicators. Policy experiments involve simulating various policy changes and assessing their effects on commodity prices. The predictive accuracy of the models is validated using cross-validation techniques. Our findings underscore the effectiveness of combining DWH capabilities with Bayesian Networks to analyze the effects of policies on agricultural commodity prices. This approach provides a high-performance solution for handling extensive datasets and deriving insights crucial for stakeholders in agriculture. The approach presented enables policymakers, traders, and, most importantly, farmers to partially mitigate risks inherent in their decisions.

University agricultural education and the development of students' entrepreneurial mindset and motivation: A study in Greece and Italy

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A pivotal – yet less emphasized – aim of tertiary agricultural education institutes is to supply students with a mindset needed to undertake entrepreneurial action after graduation. Although the European Union acknowledges the need to offer opportunities for equipping all citizens with entrepreneurial skills, and despite the inclusion of relevant courses to the curricula offered by most university institutes, limited research has been dedicated to uncovering the levels of students' entrepreneurial mindset and their motivation to undertake entrepreneurial action. In the present study, we aim to fill this gap by focusing on students from Greek and Italian universities. Following a quantitative research approach and relying on validated scales, we assessed and compared several constructs of students' entrepreneurial mindset (ideation, open-mindedness, interest, and seeking new challenges) and motivation (referring to dimensions ranging from economic to social to work-related motives). Our data suggest that Greek students are motivated to follow the entrepreneurial path by their desire to express their innovativeness and creativity, gain independence, and serve their communities. Italian students are also urged by their need to innovate, seeking, in parallel, new experiences, wealth, and personal satisfaction through entrepreneurship. Concerning entrepreneurial mindset, in both samples, students scored higher in open-mindedness than in the other dimensions examined. Interestingly, the scores found in ideation and interest – two dimensions of entrepreneurial mindset that can be cultivated through education – were moderate to high. Our results indicate that university institutes in both countries should pay more attention to enhancing future professionals' interest in entrepreneurship, connecting the meaning of entrepreneurial activity with the opportunities it offers for expressing innovativeness and creativity, and shifting focus on motivating students to think of entrepreneurship as a potential career path. Acknowledgment The study is part of an ongoing project titled “BOOSTing agribusiness acceleration and digital hub networking by an advanced training program on sustainable Precision Agriculture”. The research project is co-funded by the European Union. Project number: 101056291.

The Sustainability assessment of Agrifood SMEs: a GRI-based Tailored Model vs ESRS

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The sustainability reporting practice represents a corporate social responsibility tool enabling businesses to communicate their performance to stakeholders from consumers to investors. However, several gaps from regulatory and literature points of view concerning both the type of businesses and the sectors they belong to. In fact, Small and Medium Enterprises (SMEs) appear to face many difficulties in reporting on sustainability due to their characteristics limiting their ability to fit within codified frameworks. Nevertheless, the latest Corporate Sustainability Reporting Directive (CSRD) - 2022/2464/EU is gradually extending the obligation to report on sustainability to SMEs, but without providing them with specific reporting guidelines yet. Moreover, Agrifood sector-based versions of sustainability reporting are missing as well. Thus, there is a lack of guidance for SMEs operating in the Agrifood sector to follow on sustainability reporting activity. Therefore, the aim of the research is to provide a GRI Tailored Model suitable for Agrifood SMEs. Indeed, GRI was chosen as benchmark framework due to its widespread use. A descriptive analysis of existing GRI reports was conducted. From 121 Agrifood SMEs, 15 reports were collected and analysed in terms of material themes chosen by the firms, GRI standards frequency of usage and the informative coverage of the reports, following these research questions: 1. Which themes are identified as relevant by SMEs in the Agrifood sector? 2. Which GRI Standards are being used by Agrifood SMEs to communicate their sustainability impacts and commitment? 3. Which GRI Standards are more suitable for Agrifood SMEs? The results show a higher interest in social and environmental issues than the economic ones, although with a lack of communication on sustainable practices to preserve biodiversity, soil health and reduction in the use of pesticides. Moreover, the sample employs on average around half of the standards available. Therefore, these findings highlight an absence of minimum information threshold and the limited SMEs informative capacity. Hence, a preliminary Tailored Model for the sustainability reporting of Agrifood SMEs is proposed to assist them in these accountability practices according to their capabilities and make them better meet the expectations of civil society.

The Food Environment Approach in Urban food policy: Assessing the socio-economic factors of Parma City

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Several Sustainable Development Goals (SDGs), specifically SDG 2, SDG 3, SDG 11, SDG 12, SDG 13, and SDG 15, are closely interconnected to urban food policy, reflecting the link between food systems, urban development, and sustainability. The Milan Urban Food Policy Pact, adopted during the 2015 International Conference on Sustainable Urban Development in Milan, exemplifies this connection. Over 280 cities have signed this pact, committing to policies for equitable, sustainable, and resilient food systems. This framework addresses several issues of which diet-related non-communicable diseases in the city are one of them. Therefore, understanding city food environments (FEs), which influence dietary choices and health outcomes, is crucial for effective implementation. FEs include the availability, affordability, and sustainability of foods, while community health is shaped by both individual and community-level factors. This research assesses the socio-economic characteristics of Parma neighbourhoods and their impact on consumer dietary patterns, focusing on the type and distribution of food entry points and price variations across markets. Using descriptive statistics, the study explores the relationship between neighbourhood socioeconomic conditions and FEs, specifically physical access (proximity) and economic access (affordability). The main objective is to provide a possible ex-post and ex-ante analysis tool to help policymakers in urban food policy planning to influence healthy eating habits and awareness of food choices. Preliminary findings reveal demographic data, such as population density and age indices, influencing shopping activities. Affordability was analysed using average house sale prices and the cost of a basic product basket. Results indicate that neighbourhoods with lower housing prices have limited access to high-cost food options, while higher-priced areas enjoy a wider range of food options, including medium and low-cost items due to supermarket presence. This study highlights the complex dynamics of Parma's FEs, emphasizing that high residential purchasing power does not necessarily correlate with higher food prices or reduced affordability. Hence, additional data, such as income and community health status, particularly concerning non-communicable diseases, need to be collected to strengthen the findings.

Prediction of mycotoxin contamination in European wheat and related economic loss estimation

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Background: The presence of mycotoxins in wheat is largely influenced by weather conditions such as temperature, humidity and precipitation, which can directly affect fungal life and mycotoxin production. Climate change leads to shifts in temperature, humidity and precipitation patterns, thereby affecting wheat yield and mycotoxin contamination in harvested wheat. The aim of this study was to investigate mycotoxin contamination in wheat grown in the European region under different climate change scenarios and estimate the economic loss of European wheat due to downgrading from food to feed as a result of mycotoxin contamination. **Method:** The study used mycotoxin monitoring data, wheat phenology data, current weather data, and estimated future climate data under different climate change scenarios as inputs. The study followed a 2-step approach: 1) develop a forecasting model for the presence of mycotoxins in wheat in European regions, and 2) feed the model with climate change impact data. The economic loss under climate change was assessed when wheat, originally intended for food consumption, was downgraded to feed quality due to contamination by mycotoxins. **Results:** Results showed that mycotoxin contamination in European wheat, particularly deoxynivalenol (DON), was generally predicted to increase with climate change. The increase was expected to be highest at mid-century for the SSP1-2.6 scenario, whereas for the SSP5-8.5 scenario DON contamination was estimated to peak at the end of the century. The coastal areas, UK, and the north of France were estimated to be the regions with the highest increase of the frequency (simulated years) with high mycotoxin contamination. Wheat flowering and harvesting dates were estimated to shift to earlier dates according to SSP5-8.5 and SSP3-7.0, but remain stable according to SSP1-2.6 and SSP2-4.5. With climate change, decreased precipitation, increased relative humidity and temperature, and advanced flowering showed to have the highest impact on the high mycotoxin contamination in wheat. Of the different climate change scenarios, the estimated loss of European wheat due to downgrading from food to feed as a result of mycotoxin contamination was highest under SSP5-8.5; this loss corresponded to 2.5% of the wheat grown and €15.7 billion in 2050. **Conclusions:** The developed prediction model and scenario results enhance the understanding of the distribution of potential mycotoxin contamination due to climate change in wheat grown in Europe. Estimation of the wheat crop loss due to the food safety burden could support food security decision-making.

Integrating Invasive Fish Species Management with Functional Food Production: A Sustainable Approach to Marine Ecosystem Restoration and Climate Threat Mitigation

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The Mediterranean and Aegean regions are increasingly facing significant disruptions in their marine ecosystems due to the proliferation of invasive fish species. These species, often introduced unintentionally, threaten the biodiversity and balance of marine habitats, leading to adverse ecological and economic impacts. This study explores an innovative approach to addressing this issue by integrating the management of invasive fish populations with the production of functional foods, specifically focusing on collagen extraction. Invasive species such as the lionfish and pufferfish have become prevalent in these regions, disrupting native populations and altering the ecological equilibrium. Traditional management practices often involve the targeted fishing of these species to reduce their numbers and mitigate their impact. However, this approach results in an oversupply of harvested fish, posing challenges in terms of sustainable utilization. To address this, our study proposes the extraction of collagen from the biomass of these invasive species. Marine collagen, known for its beneficial properties in food, cosmetics, and pharmaceuticals, presents a valuable resource that can be derived from these otherwise underutilized fish stocks. The extraction process not only aids in managing invasive populations but also contributes to the circular economy by upcycling biological waste into high-value products. Collagen-enriched functional foods produced from invasive fish species offer multiple benefits. They enhance food security by providing a new source of nutritious and health-promoting ingredients. Furthermore, this approach supports sustainable fishing practices and marine ecosystem restoration, aligning with broader climate change mitigation strategies. The proposed model integrates ecological management with industrial innovation, creating a symbiotic relationship between environmental sustainability and economic development. By utilizing invasive species for collagen production, we can transform a climate threat into an opportunity for generating value-added products, ultimately contributing to the resilience of marine ecosystems and the agri-food sector. This research discusses the following key areas: 1. The impact of invasive fish species on the marine ecosystems of the Mediterranean and Aegean regions. 2. Sustainable harvesting practices aimed at restoring ecological balance. 3. Methods of collagen extraction from invasive species and their potential applications. 4. Integration of collagen-enriched functional foods into traditional agri-food chains. 5. Case studies demonstrating successful implementation and outcomes. Our findings underscore the importance of innovative and sustainable solutions in addressing the dual challenges of ecological disruption and climate change. By reorienting the agri-food chains to include upcycled marine resources, we can achieve both environmental and economic benefits, fostering a more resilient and sustainable future.

The impact of climate change on beekeeping in Crete, Greece

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Beekeeping in the Mediterranean region is an economic activity at risk under the unprecedented challenges faced by climate change. Previous studies have explored the impact of climate change on beekeeping in different regions across Europe. However, there remains a significant knowledge gap in understanding these dynamics from the viewpoint of beekeepers within the Mediterranean region, and Crete in particular. This study, conducted by master's student Gana Lyes Younes, under the supervision of Dr. Wim Verbeke, Dr. Yiorgos Gadanakis, and the head of the business department Eleni Stamataki, with research contributions from the food department researcher of Mediterranean Agronomic Institute of Chania Panagiota Gotsiou, aims to address this gap by assessing the impact of climate change on beekeeping on the island of Crete (Greece). A cross-sectional survey (n=68) was carried out in the spring of 2024 among beekeepers across Crete. This research explores the association between socio-economic characteristics, economic performance, management practices, technology use, and adaptation strategies among beekeepers in response to climate change. Initial analysis shows that the average honey production per hive amounts to 10 kg/hive, which matches the EU average. Additionally, most beekeepers identify the impact of climate change as negative (66%) or very negative (27%) but vary in their mitigating actions. These include the frequency of feeding bees (88%), migration of beehives (81%), and increased workload during spring and summer (84%). Moreover, 77% of beekeepers agree, based on their personal experience, that climate change is one of the biggest challenges they face. Furthermore, with the current data, we measured the correlation between adaptation to climate change and good quality management scores with honey yield, revenue from honey sales, and colony winter loss rates. Preliminary results show that there is a positive correlation between adaptation and management score with honey yield and beekeepers' revenue, and a negative correlation with colony winter losses.

The impact of geographical indications on farms' performance. An empirical analysis of the EU vineyard sector

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The European Union protects nowadays more than 3,800 names of agricultural products and foodstuffs, wine, and spirit drinks under the food quality scheme (FQS) Geographical Indications (GIs). Pursuing the sustainability-related objectives, the European Green Deal and its Farm to Fork strategy also aim to strengthening the legislation on Geographical Indications. This was also reflected in the Council's conclusions on the Farm to Fork strategy in October 2020 where the relevance of better integrating the concepts of sustainable development into the European quality policy was stressed by the Council. Overall, there is lack of empirical evidence of GIs impacts on farms' and agricultural performance in the scientific literature, thus preventing a deeper understanding of the GIs' economic performance. On top of the economic aspect, it is not clear whether GI farms boost agricultural employment, and how these special production process of the GI's impact the environment; microeconomic studies concerning all three dimensions of sustainability are scant. The present report aims at bringing quantitative estimates of the GIs impact on the performance of vineyard farms for selected economic, environmental and social (labour) outcome indexes. Relying on the EU FADN database for the vineyard sector, we cover 149,864 vineyard farms for the period 2004-2020. We employ a combined matching (CEM) and difference-in-differences (DID) technique to compare similar farms producing GI and conventional products. A two-way fixed effect econometric estimator is applied on the matched farms at four different territorial (NUTS) levels, ensuring the comparison is, at most, at the country level, in the attempt of reducing the bias of reputational and territorial-specific element (e.g., purchase power, consumer cultural preferences, among others) that may significantly shape the output value of the product. We also consider different standardization to test for the robustness of the estimated results (per area, per annual working units, per area devoted to permanent crops, per family annual working units). Moreover, by combining a matching technique and a DID estimator, the adopted approach can address the self-selection bias of farms into GI, both time-invariant and time-variant systematic differences across farms and the functional form misspecification of the estimated model. Different farm performance related indicators related to economic (i.e., vineyards total output, farm net income, farm net value added, total crops total output), environmental (i.e., energy use and plant protection expenses) and social (i.e., wages, intensity of paid work, family work and total work). Results confirm that GIs improve economic performance of vineyard farms, across different NUTS level matchings and measurement units. We find that GI farms tend to pay higher wages to farm labour than their conventional counterparts, although no significant effects on the intensity of labour. On the environmental side, although the results provide some support that the energy use may be lower in GI farms, estimates are not robust across model specifications. Plant protection clearly shows non-significant differences.

Can we observe relation between environmental subsidies, biodiversity and motivation of farmers in Czech agriculture?

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The paper deals with an analysis of the relation among environmental subsidies, biodiversity and motivation of farmers in Czech agriculture. The analysis is carried out using the FADN database and the micro level perspective. The motivation of farmers is based on the concept of economies of scope and cost complementarities of outputs. We use the stochastic input distance frontier models that are applied on the main agricultural sectors to provide the inter- as well as intra sectoral comparison of Czech farmers. The study hypothesized that farm agri-environmental commitments such as adoption of conservation practices generally prerequisite substantial changes in production technology and are therefore supposed to influence economies of scope and scale effects, and to impact farm practices addressing resource scarcity. That is, to better understand the determinants of structural adjustments in agriculture considering farm agri-environmental commitments and economies of scope and cost complementarities may provide evidence on the motivation of farmers to produce both environmental and marketed outputs. The preliminary results show that there are significant differences among the sectors. Moreover, due to the dual structure of Czech agricultural we found significant differences in the cost flexibility between small and large farmers or agricultural companies, respectively. In particular, the small farmers have higher cost flexibility than the large ones. However, more systematic research is still required to understand the potential for improving local eco-system resilience and productivity by engaging in more integrated production systems.

Fallow land in the EU – How are agricultural revenues and markets affected?

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Our objective is to show different projections and their effect on agricultural markets and revenue regarding requirements to set-aside land in the European Union (EU). The policies concerning fallow land have frequently been eased in the past compared to the original proposal in the current EU Common Agricultural Policy (CAP), e.g., as a response to the recent farmers' protests. However, the policy might be subject to change in the future in the different direction, e.g., due to the target of reaching a share of 10% of agricultural area under high-diversity landscape features which is stated in the EU Biodiversity Strategy. Our research question is: How would farm revenue change in the different EU Member States (MS) with changes in fallow land policies? Therefore, the partial equilibrium model AGMEMOD is updated, extended and applied. One baseline and three scenarios are simulated which vary the amount of fallow land. The baseline considers the non-productive area resulting from the Good Agricultural and Environmental Conditions 8 and existing voluntary eco-schemes as presented in the National Strategic Plans by each EU MS. The scenarios vary the share of non-productive area, i.e., fallow land, in arable land from setting requirements to 0%, 10% and going back to the policy option which existed in the CAP period 2014 to 2022 under the Greening and via Ecological focus areas. The analysis gives insights per MS on changes in agricultural revenue based on changes in production and prices. The effects in the MS are very heterogeneous: revenues decline in some MS while increase in others in each scenario compared to the baseline. This depends on the status quo and the different policy options used in each MS. Preliminary results show a maximum change in farm revenue between +4% and -4.2% in a MS depending on the scenario compared to the baseline. Farm revenue in Estonia is most responsive to changes in fallow land followed by Bulgaria and Sweden. Least responsive are Spain, Malta and Cyprus.

Economic performance of apple tree farming in Greece

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The purpose of this study is to estimate the economic performance of apple tree farms and assess their productivity and sustainability. Technical and economic data were collected from 95 farms located in prefectures, Florina, Kozani and Kastoria in Western Macedonia, Greece, through a farm management survey. The survey was conducted using a well-designed questionnaire during October 2023 to March 2024. Apple production in Florina, Kozani and Kastoria constitutes one of the most important agricultural activities in the area and it is characterized by its high-quality products. Apples from these regions stand out for their taste and their nutritional value, while apples produced in Kastoria are registered as a P.D.O. product since 2002. The main economic results and the key cost drivers of the farms were estimated and compared across these regions. The results indicate that the hired labor cost, the expenses for procurement of agrochemicals (pesticides and fertilizers) and fuel are the main sources of expenses in apple farming. The production cost is relatively high mainly due to the high prices of pesticides and fertilizers, the energy and irrigation costs, and the high dependence on machinery which results in high fixed costs. The results show that the majority of the farms (more than 90%) had losses which indicates that in the long-run the farms may not be sustainable. However, the results also reveal that more than 60% of the farms have positive gross margins and achieve a satisfactory farm income. The adoption of best practices and innovations in apple tree farming, including precision agriculture techniques, automated processes, and enhanced marketing practices in order to achieve higher producer prices, will secure the sustainability of the sector and will support its long term development. Innovations and best practices can increase the sector's productivity and efficiency, hence, protecting apple tree farming from asymmetrical threats that may occur because of climate change.

National-scale diet change and international trade dynamics

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This study investigates the economic, environmental and food security trade-offs associated with wide-spread changes in diet. The primary focus is on how the adoption of alternative diets in the UK impacts agricultural commodity prices, international trade flows, greenhouse gas emissions, and nutrient imbalances. The interaction with parallel dietary trends in the EU is also explored. Partial equilibrium models of UK (FAPRI-UK) and European (FAPRI-Gold) agriculture are used in the study. A business-as-usual ten-year outlook for prices, production, and trade is contrasted with counter-factual scenarios that assume dietary patterns materially shift at national-scale in the UK. Several alternative diet-change pathways are implemented. Greenhouse gas emissions (nitrous oxide and methane) linked to crop and livestock production, and nitrogen and phosphorus balances, are also compared across scenarios. Unilateral diet change at national scale in the UK is expected to have a relatively larger impact on international trade flows than domestic production levels, particularly in sectors with a sticky supply response such as beef and sheep, or, those that are well integrated in world markets such as cereals and dairy. Multilateral diet change in both the UK and EU is expected to have a more pronounced impact on production-levels, crop mixes, and prices when domestic demand shifts are mirrored by the UK's main trading partners. The pattern of dietary change is expected to have a central role in shaping how conflicts and complementarities play out in terms of farm incomes, food affordability, self-sufficiency, balance of trade, greenhouse gas emissions, and problematic excesses of nutrients.

Reforming budgetary support to agriculture: GHG emission impacts, co-benefits and trade-offs

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Agriculture is among the sectors the most exposed to climate change, but it is also an important source of greenhouse gas (GHG) emissions. Reforming agricultural support is increasingly considered a viable means to increase agriculture's contribution to climate change mitigation, while fulfilling broader food systems policy objectives related to food security and livelihoods. This study investigates the impact on GHG emissions from a set of global policy reform scenarios that reorientate governments' budgetary transfers to agriculture, using the METRO-PEM computable general equilibrium model. This model has the specificity of directly integrating the latest data on agricultural support from the OECD, analysed at policy line level, into the modelling framework. The results suggest that removing budgetary support globally would reduce agricultural emissions by 2.1% with potential negative effects on food supply. Reorienting existing support, instead, could have significantly stronger effects: decoupling payments from production and tying these to suitable agri-environmental practices could raise emission reduction to over 4% without harming food supply. Targeted investments in productivity and abatement technologies could bring additional emission savings in the long term with co-benefits for food security. Combining long-term investment programmes with the above agricultural support reforms appears to be the most promising and cost-effective approach to deliver the transformations required in long run. Blending decoupling of the potentially most climate-harmful payments, environmental measures and targeted investments in productivity and abatement technologies in the OECD would reduce global agricultural emissions by 5% – or by 11% if extended to other regions – while balancing outcomes across the three dimensions of the food systems' triple challenge.

Understanding Climate Change Impacts: Perspectives and Strategies of Farmers in Serbia

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Droughts, flooding, natural disasters, diseases, biodiversity loss, soil erosion, market fluctuations, and food insecurity are just some of the significant impacts of climate change on agricultural production worldwide. Recognizing the importance of these influences, numerous global initiatives have been undertaken, including the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, the Paris Agreement, and various collaborative initiatives and alliances. Robust policy frameworks have also been established at both national and regional levels around the world. This acknowledges the complex and global nature of climate change, which requires coordinated action from businesses, NGOs, governments, and international organizations. However, the effectiveness of human action ultimately relies on individual perceptions. Awareness of climate change and its impact on agricultural practices varies among producers, influenced by factors such as the type of farming, socio-economic characteristics, and business strategies employed. This paper explores the perceptions of agricultural producers in Serbia regarding the importance of climate change, highlighting their characteristics and potential future actions. Based on a sample of 273 observations, the research aims to analyse the differences of two groups of farmers: those who are aware of the impact of climate change on their practices and those who do not perceive this influence as important. The Mann-Whitney test is used to compare these two independent samples of farmers. Their perceptions of economic, environmental, and social indicators are analyzed to understand the overall influence of climate change on their sustainability. By adopting various strategies, farmers can enhance their resilience to climate change, maintain productivity, and contribute to mitigating its impacts. This requires a combination of traditional knowledge, modern technology, and supportive policies to create sustainable and climate-resilient agricultural systems. Efforts to increase awareness and provide resources for climate change adaptation and control are crucial, especially for vulnerable, resource-limited farmers in developing countries. It is highly recommended to implement diverse societal actions to improve access to information and financial support, helping farmers better understand and mitigate the impact of climate change on their livelihoods.

The impact of sustainable consumption on supply chain management: an EU-wide study

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Consumers have the power to drive the adoption of sustainable supply chains through their purchasing choices. Encouraging environmentally responsible consumption not only benefits the environment but also incentivises producers and suppliers to adopt sustainable practices. For example, a Spanish case study on seafood consumption highlights the influence of consumer behaviour on sustainable supply chains. By making eco-conscious decisions about their mode of transportation and cooking methods, consumers can significantly minimise the environmental footprint of seafood consumption and its associated supply chains. The purpose of the current study is to examine the effects of sustainable consumption patterns in the European Union (EU) on the design and management of sustainable supply chains. A survey was conducted with a sample size of 3000 respondents, representing different EU regions and demographics. The survey aimed to gather data on the participants' purchasing habits, including the types of products they buy, the frequency of their purchases, and the factors that influence their choices. The collected data were then statistically analysed using clustering to identify common consumption patterns among the respondents, creating segments of similar behaviour. Further exploration was conducted, employing factor analysis, to determine the association between these patterns (segments) and the design and management of sustainable supply chains. The study found that sustainable consumption patterns, such as the preference for locally sourced products or products with minimal packaging, are closely linked to sustainable supply chain management. Overall, this study provides valuable insight into the relationship between sustainable consumption patterns and supply chain management across the EU.

The livestock system in the Netherlands under attack: an Applied General Equilibrium model approach

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Agrifood systems “encompass primary agricultural production of food and non-food products, the production of food of non-agricultural origin, the food supply chain from producer to consumer and the final consumer of food” (FAO, 2021). Ideally agrifood systems are resilient, sustainable and provide nutritious food and livelihoods for those involved. However, in the Netherlands this is not the case for the livestock system due to the oversupply of minerals to the environment. For this reason, livestock number reductions up to 50% are proposed in the policy debate. Such a large reduction not only affects livestock farmers but also the compound feed companies, the meat industry, dairy processing, advisory firms, and others. Moreover, significant trade effects can be expected, as the Netherlands is a major exporter of livestock products and importer of feed (e.g., soya). Given that the livestock system involves many actors interacting at different stages of the value chain, quantifying the effects of livestock reduction requires specific methods. One possibility is value chain analysis, which consists of a detailed description of the value chain and its external environment, a sustainability assessment, a SWOT analysis, and the formulation of strategies. Another alternative is the use of Applied General Equilibrium (AGE) models. AGE models represent the economy as a whole, including all its actors. This paper aims to develop an AGE model of the Netherlands to analyze the effects of a significant reduction in the livestock sector. Reducing livestock numbers results in relatively small effects on overall value added and employment, with the largest impact seen in the feed and processing industries. Unsurprisingly, these industries are significant lobbyists against a smaller livestock sector. However, the environmental benefits of reducing livestock numbers are substantial. The outcomes derived from the AGE model are smaller than those from partial equilibrium models. This is due to the AGE model's consideration of larger substitution possibilities in both product and factor markets, which allows for more flexible economic adjustments and thus smaller effects. An important factor in the analysis is the leakage effects via trade. If production shifts to countries with less stringent environmental regulations this leads to greater global environmental degradation.

From Fork to Footprint: Unveiling the Environmental Impact of Food Consumption across Income Divides

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Understanding the distribution of the impact of consumption on global environmental outcomes across its actors is pivotal for public policy design. This study delves into Austria's food consumption patterns, unearthing disparities and potential leverage points by exploring two policy scenarios to mitigate emissions from the food sector. Globally, food accounts for around a third of greenhouse gas (GHG) emissions (Shukla et al., 2019). While literature on the impacts of food systems as a whole is abundant, less is known about the distribution of environmental repercussions of consumption across socioeconomic groups. Emissions are not distributed evenly, with lower-income households producing significantly fewer emissions than higher-income households. Moreover, taxes on food can be regressive, disproportionately affecting low-income individuals who spend a larger portion of their income on essential goods like food. This study analyzes household spending patterns obtained from the Austrian household budget survey (HBS) and associated environmental impacts. By considering factors such as education, urbanization, and age, the research aims to provide insights into dietary variations among income groups while controlling for other socioeconomic influences. The analysis utilizes monetary values and physical quantities derived from the HBS dataset. An EASI demand system is estimated, exploiting the variation in price over time to derive non-linear Engel curves and cross-elasticities. GHG emissions from food are calculated by matching HBS products with values from the database compiled by Petersson et al. (2021), which uses life-cycle analysis. The study explores two policy scenarios: (i) the introduction of a carbon tax on foods with greater climatic impact, and (ii) a reduced VAT rate on lower-impact foods in combination with a carbon tax. The findings indicate that lower-income households are less elastic to price changes than higher-income households. This translates to an expansion of the budget share for food rather than a substitution towards cheaper food products. I show that GHG emissions are 1.5 times higher for high-income households than those from low-income households.

Perceived Performance Evaluation of a Two-layered Agribusiness Firm: The Case of Marketing Cooperative

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Agribusiness cooperatives (coops) in the European Union contribute substantially to the alleviation of the resource curse by promoting sustainable resource management and food systems' resilience. Coop members typically maintain the entrepreneurial lead for themselves (i.e., their own business – the first layer of entrepreneurship) and view the cooperative firm as a task organization in a common front-office (i.e., marketing cooperative firm – the second layer of entrepreneurship) that achieves differentiation in response to rapid market challenges. In this paper, we study the impact of a) member-owned business characteristics (size; debt/equity ratio), and member attitudes (market-orientation, entrepreneurial-orientation, risk-taking) on the performance of member firm (at farm level, the first layer); and b) members' choices about intra-organizational (ownership, control, and benefit allocation) and attitudes for strategic attributes (market-orientation, entrepreneurial-orientation, risk-taking) on cooperative's organizational performance (at the cooperative level, the second layer). Using data from 178 agribusiness cooperative members in the Netherlands, the results indicate that members' attitudes for risk-taking and market-oriented behavior have a greater impact on cooperative's performance rather than their own firm's performance. In contrast, members' attitudes for entrepreneurial orientation have a greater impact on their own firm's performance rather than cooperative's performance. Cooperative members seem to take a full entrepreneurial lead at their own business (the first layer), while they seem to assign the task for more market-oriented strategies and risk-taking behavior to the cooperative level (the second layer). This suggests that member-producers generally prefer to participate in a task organization entailing a common front-office with a strong entrepreneurial lead. Studying the drivers of agribusiness coops and member firms' performance may provide crucial information to cooperative policy makers and managers regarding the re-orientation of coop members' strategic goals, performance targets, and sustainable development.

The impact of Russia's war in Ukraine on the integration of grain markets in Ukraine and the Black Sea region

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With Russia's full invasion of Ukraine and the military blockade of the Black Sea ports, Ukraine's global supply chains for agricultural goods were disrupted. Alternative logistics routes were opened up quickly within the newly established EU-Ukraine Solidarity Lanes by truck and train via Ukraine's Western border and ship via the Danube River. Since Russia had lost its military dominance in the Black Sea, Ukraine could open up a Humanitarian Corridor along the coastal line of NATO countries for agricultural export after Russia had left the Black Sea Grain Initiative. We analyze weekly time series price data in a multivariate cointegration framework represented as a vector error correction model. We compare the strength of price relationships and the speed of corrections of temporary shocks of Ukraine's corn export market and world markets before Ukraine's war with the time period of the restricted export possibilities during the Black Sea Grain Initiative. We also analyze how has the integration of Ukraine's corn market in Eastern EU countries' markets has developed, given the new logistic routes and the changed policies in EU-Ukraine corn trade. Results suggest Ukraine's corn market to have disintegrated from international markets due to increased transport costs. Also, Ukraine's dominance regarding short-run international price formation weakened. However, integration of Romania's export market at Constanta port in the international market has strengthened due to the increase of its corn exports. We find Ukrainian corn prices at the Western border and at the Danube ports highly integrated with export prices at Odesa ports. Long-run price integration of the Ukraine Odesa export market with regional markets in Hungary and Romania has decreased, but still remains of considerable size. Though, Ukraine Odesa export market's importance for price formation in Hungary strengthened, while its' importance for price formation in Romania weakened. Well-functioning corn supply chains with unrestricted export opportunities via the Black Sea are key to stop corn price erosion in Ukraine which is to some degree transmitted to the EEU countries. Thus, investments in logistics are required to better integrate regional EEU markets with international markets, particularly in Hungary but possibly also Poland, to cushion EU –Ukraine free trade price effects.

Advancing agroecosystem resilience through Intercropping: insights from topic modeling, meta-analysis, and field studies on cereal-legume systems

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The increasing challenges posed by climate change have intensified the need for more resilient agroecosystems, spurring interest in diversifying crop rotations and reducing reliance on monocultures. Intercropping, particularly the combination of small-grain cereals with grain legumes, offers a promising approach to enhance yield stability and sustainability in agricultural systems. While intercropping is associated with several well-known benefits—such as improved nitrogen fixation, reduced weed, disease, and pest pressures, lower lodging risks, and decreased reliance on mineral fertilizers—it remains underutilized in Europe due to technical, economic, and policy barriers. This study integrates topic modeling and meta-analysis to explore the prevailing trends in intercropping research and its potential to contribute to sustainable intensification. The analysis identifies key themes, such as the widespread focus on cereal-legume combinations, particularly maize, wheat, and soybean, and the emphasis on yield and nitrogen fixation as primary research topics. Additionally, in field trials on faba bean and triticale intercropping systems, conducted across three varieties per species in multiple European climates, aims to assess both provisioning and regulating ecosystem services. Preliminary findings suggest that intercropping performance varies significantly with crop ratios and sowing densities, and that different performance metrics may yield contradictory assessments of intercropping benefits. The research underscores the potential of intercropping, especially with orphan crops characterized by broad gene pools, to enhance agroecosystem resilience and sustainability. These crops, with their high nutritional value and ecological benefits—such as nectar-rich flowers and reduced input requirements—offer significant opportunities for developing new food, feed, and non-food products. The ongoing study aims to deepen our understanding of these dynamics, with results and conclusions to be discussed upon completion of data analysis. This study is part of the CROPDIVA project (Horizon 2020, grant agreement NO 101000847).

Posters

Heightening sustainability transition in the fresh produce industry

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Developing more sustainable business models has become increasingly crucial for the survival of agri-food industries as environmental and social pressures from different types of stakeholders are escalating. However, limited attention has been given in scientific literature to the relationship between business modelling and sustainability implementation, especially in scholarly studies focused on food companies and supply chains. Therefore, this contribution aims to address this research gap using the Triple Bottom Line (TBL) model as a framework for enhancing sustainable value creation schemes in the fresh produce industry. In this approach, the standard, economic-centered business model is innovated and transformed in a sustainable business model through the integration of sustainability concerns. The empirical study entailed the following consecutive steps: literature review for both the fresh produce industry and business models, conceptual adaptation of the TBL general framework to the specific context of the fresh produce industry, data collection, and analysis and discussion of results. Findings indicate that the TBL model can be an effective tool to expanding classical economic business models, which can transform significantly the value propositions and differentiate the offerings. More importantly, the TBL approach facilitates the identification of potential business model innovations and improvements in terms of sustainability goals, providing consequently diverse options on how the fresh produce industry can benefit from integrating sustainability into business practices. It is also shown that the transition toward sustainability is crucial since the efficient integration of sustainability objectives may lead to increasing sustainable performance as well as the development of sustainable operations, which can improve market positioning. Companies focused on sustainable value creation integrating socio-environmental standards tend to operate in supply chains based on trust, transparency and close stakeholder relationships, which ultimately are key assets for competitive advantage. These companies also are more capable of adapting swiftly to unforeseen, external shocks, these being health, climate or financial.

Water buffalo production in Greece: Challenges and prospects in a competitive environment

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Greek water buffalo (GWB) is an indigenous breed which supports the operation of extensive and semi-intensive farms in Greece. The breed and the relevant production system are gaining increasing attention for reasons relating to the uniqueness of the breed - which is supported under the Strategic Plan of the Common Agricultural Policy of Greece 2023-2027 - equally to the quality of its products. Nevertheless, GWB also contributes highly to the provision of environmental and sociocultural services. This paper presents the results of a descriptive technical and economic analysis incorporating data from the farms rearing GWB in the area of Kerkini, which is the main center of the breed in Greece. Farms are categorized according to their intensification levels into two groups. Extensive farms are the ones mostly dependent on grazing in the local wetlands while semi-intensive farms increasingly choose to provide supplementary feeding to livestock. Also the latter farms invest in buildings. The difference in intensification levels is also reflected in the market outlets and productivity of farms. As a result, semi-intensive farms perform better in terms of economic results (gross revenues and gross margin) but extensive farms are more dependent on family labor and thus more flexible in coping with external shocks. The prospects for integration in markets of both farm types relate to the identification of market segments where their products cover for the needs and expectations of consumers. For this reason, the project Quality Bubalis adopts an integrated approach of the system and focuses on improvements in product quality (milk and meat) in order to assist farms diversify and get closer to market demand. Especially the valorization of milk - which is a highly appreciated product in other countries but lags in Greece - can provide a significant source of income for GWB farms. The analysis focuses on this activity and highlights its prospects through partial budgeting, thus demonstrating how the valorization of milk can affect the economic performance of both farm types.

The role of precision agriculture in sustainable food supply chains

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The growing demand for food security and sustainability, environmental concerns and climate change adaptation underline the importance of efficient use of agricultural resources. Precision agriculture can be one of the means to achieve these objectives. According to recent international trends, robotics and artificial intelligence will also play a significant role in agriculture. The aim of our study is to examine the current status and role of precision agriculture, with a particular focus on its effects on sustainable food supply. The study is essentially descriptive and uses secondary data as primary source. However, the authors have also completed a non-representative primary survey of farmers in Hungary. The main question of the research was what actors think about the role of precision farming. The demand for agricultural products is expected to grow dynamically in the coming decades and this growing demand can only be met by more efficient production. Mechanisation, precision farming technology and agricultural information technology have made significant progress in recent years. Precision farming is the practical application of digital agriculture, where developments are focused on how to farm more competitively and increase efficiency, while also placing a strong emphasis on environmental sustainability. Our research shows that farmers are open to precision technology solutions, but there are challenges to the uptake of new methods. The competitive future of agriculture is also influenced by digitalisation and the use of precision agriculture and robotic systems. Precision agriculture is becoming increasingly widespread in practice as it can make a major contribution to sustainable food production.

The role of opportunistic behavior to the performance of agricultural cooperatives

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Agricultural cooperatives undoubtedly hold a regulatory role in the agri-food supply chain. Their contribution and role in addressing a constellation of challenges in the modern socio-economic reality of the agricultural sector are also substantial. Food security, preserving natural resources and inflation are now becoming more necessary than ever due to the vast effects of climate change. Thus, cooperatives can contribute by enhancing fair trade, market transparency, balancing transaction costs by promoting short-food supply chains, supporting local producers with ethical prices and emphasizing demand for goods that could promote biodiversity and zero-food miles, among others. To cope with these challenges, cooperatives should be robust with proper flexibility in management and high levels of social capital. In other words, opportunistic behavior among their members should be minimized. The objectives of this study are to describe these phenomena and explore their correlation with the performance of agricultural cooperatives in tackling these current issues. To address these research objectives, personal interviews were carried out among cooperative experts at the beginning of 2024 using purposive sampling. The findings of the qualitative survey confirmed the existence and the consequent negative impact of the aforesaid circumstances on the proper function of cooperatives. Cooperatives that employ innovative mechanisms, such as blockchain technology, to detect opportunistic behavior could improve their performance as well as their regulatory role in the agri-food chain. Furthermore, the adoption of strategies to strengthen their social capital with the simultaneous use of sustainable food production practices and marketing strategies contributes to the efforts for sustainable development. The systemic combination of both conditions not only empowers a cooperative's performance, and hence its members' benefits, but also the community in which they operate with multiple benefits for the economy, the society as well as the environment.

Holistic Farm Management Model Based on Cross Compliance Rules via Multi-Criteria Analysis Method

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This study introduces a Decision Support Model (DSM) employing Multi-Criteria Decision Analysis (MCDA) within the Common Agricultural Policy (CAP) 2021-2027 framework. The DSM is engineered to facilitate the assimilation of new cross-compliance rules and bolster agricultural efficiency and profitability through optimized land use. It operates on a theoretical premise that fuses economic optimization with sustainable resource management, offering a solution to the multifaceted challenges of contemporary agriculture and ensuring CAP regulation adherence. The objectives of the DSM are as follows: to amplify gross profitability by steering farmers toward the most economically viable crops and practices, to abate the financial burden by minimizing variable costs such as consumables and mechanized labor, to enhance labor efficiency by reducing requisite labor hours and to advance environmental stewardship through prudent water use. The research questions probe the capacity of the DSM, when applied through the MCDA framework, to yield tangible enhancements in farm profitability and resource allocation, aligning with both economic goals and CAP's environmental mandates. The MCDA methodology involves a rigorous evaluation process that synthesizes multiple agricultural objectives, such as cost, labor, and water usage, against profit maximization. The DSM's practicality is gauged using empirical data from agricultural enterprises in Western Macedonia, Greece. The anticipated outcomes of this research include significant improvements in economic returns and operational efficiencies for farmers, with an expected decrease in input for two farmer groups. The DSM is expected to offer a strategic pathway to navigate the new CAP budget and regulatory constraints, providing a sustainable edge in agricultural practices. This research underlines the indispensability of advanced decision-support tools in agriculture, forecasting a transition to more data-informed and policy-aligned farming operations.

Exploring the multifaceted benefits of green leafy vegetables - promoting biodiversity for enhanced health, environmental benefits, and sustainable practices

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Green leafy vegetables (GLVs) are recognized for their culinary versatility and exceptional nutritional richness, making them indispensable components of diets worldwide. This paper provides a comprehensive exploration of GLVs, encompassing various dimensions from botanical characteristics to their socio-economic, cultural, and environmental implications. Beginning with an overview of GLVs' botanical diversity and culinary applications, the paper elucidates their prevalence in diverse culinary traditions globally. The nutritional benefits of GLVs, including their rich reserves of vitamins, minerals, antioxidants, and dietary fiber, are meticulously examined, along with evidence supporting their role in mitigating chronic diseases. Furthermore, the socio-economic and cultural dimensions of GLV consumption are explored, shedding light on their historical contexts, cultural significance, and economic ramifications. The paper also delves into the potential for promoting biodiversity, environmental sustainability, and food security through increased GLV cultivation and consumption. Additionally, it addresses technological advancements, market dynamics, and sustainability considerations in GLV production, as well as the impact of the climate crisis on postharvest handling. By synthesizing insights from diverse academic realms, including nutrition, medical science, economics, sociology, and agriculture, this interdisciplinary study underscores the pivotal role of GLVs in fostering human health, well-being, and sustainable development.

Agricultural Cooperatives: Roadblocks to Achieving Climate Change Resilience and Food Security

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Agricultural cooperatives have become essential entities in the global agri-food industry, serving a crucial function in addressing the interconnected challenges of climate change and food insecurity. Cooperatives that operate under ethical and sustainable practices possess the capacity to aid in the conservation of biodiversity in ecosystems, mitigate the adverse effects of climate change, and reduce food insecurity. This occurs as a result of their promotion of environmentally sustainable methods and their role in regulating the agri-food supply chains. However, some cooperatives fail to attain these goals for a variety of reasons, the most common of which are related to governance. Leadership issues, structural complications, communication barriers, cooperation and collaboration issues, market and economic roadblocks, and legal and policy impediments are all potential challenges. This study explores the various factors that contribute to agricultural cooperatives' failure to successfully address food insecurity and mitigate the harmful effects of climate change by promoting more resilient farming practices. To address this objective, we conducted ten (10) personal interviews with cooperative experts. We performed transcript and thematic analysis. The primary results of this qualitative study indicate that agricultural cooperatives' ability to combat food insecurity and climate change while preserving biodiversity is dependent on excellent governance, effective communication, cooperative efforts, economic viability, and supportive legislative frameworks. Lack of these driving forces may result in low sustainable performance of a cooperative. Furthermore, the findings of the individual (face-to-face) expert interviews provide extensive insights into the roadblocks to achieving climate change resilience and food security, and allow us to draw upon practical recommendations for overcoming the identified obstacles.

Enhancing Sustainability in Agri-Food Chains with Digital Food Passports: An Analysis of Stakeholder Perspectives from Farm to Packaging

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Drawing on the results of a national pilot project for a digital passport system in the beef, pork, and potato markets in Poland, the objective of this research is to investigate the socio-economic frameworks and complexities of implementing digital food passports to enhance sustainability. This investigation closely examines the attitudes, requirements, needs, and expectations of stakeholders operating in and supporting the upstream of the agri-food supply chain – from primary production at the farm level to packaging. The study will specifically highlight the varied perspectives of stakeholders regarding the functionalities and roles of digital food passports, their willingness to cooperate and share production data, and their engagement in sustainability efforts facilitated by this digital system. The following research questions guide the analysis: 1) What are the key factors that influence stakeholders' decisions to adopt and utilize digital food passports within the agri-food supply chain, and what are the perceived benefits and challenges associated with their implementation? 2) To what extent does the type and scope of data stakeholders are willing to share through digital food passports support sustainability efforts in agri-food supply chains, particularly considering the challenges outlined by the European Green Deal? The study is grounded in the theory of participatory innovation, which emphasizes the importance of stakeholder engagement in the development and implementation of new technologies. A case study method is employed to gain in-depth insights into participatory innovation processes. The research design involves a review and analysis of pilot project documentation, stakeholder interviews, surveys, process modelling and feedback collected during and after the implementation of the pilot. Expected outcomes include the identification of key factors influencing stakeholders' adoption and utilization of digital food passports. Also, insights will be provided into the extent and type of data stakeholders are willing to share to improve sustainability through digitalization of agri-food chains. Beyond the Polish context, the findings from this research hold potential to inform the adoption of digital food passports in agri-food chains across other countries and regions.

Managing soil health in EU: the role of Institutions

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A healthy soil, according to the EU definition contained in the Soil Health Strategy to 2030, should be able to deliver several ecosystem services (ES), including, beyond food and biomass production, support to water and nutrient cycles and preservation of cultural heritage and biodiversity (Lehmann et al., 2020). Both market and regulation failures have been considered among the main drivers of land degradation (Winkler et al., in press). Yet the lack of a comprehensive and above all a more binding EU regulatory framework has resulted in insufficient provision and inadequate remuneration of ES related to soil, which is a challenge to promoting sustainable soil management, as particularly evident in the case of public goods delivery in the context of agricultural production (Bartowski et al., 2018). Although it is relevant, scant literature investigates the interplay between soil (and related ecosystem services) and property rights. However, most land is subject to these property rights. Literature has empathized that those policies aimed at increasing the share of own-operated farmland or long-term leasing would also benefit soil health due to an alignment between private and public long-term objectives (Stevens, 2022). Given this context, our study delves into the role of governance structure in promoting SSM. Using a qualitative approach, we conduct a comparative analysis of 11 case studies from various EU countries. We base our analysis on the four institution levels proposed by Williamson: Embeddedness, Institutional environment, Governance, and Allocation of resources. The preliminary findings underscore institutional gaps (meso-institution), which can support the development of an effective soil health strategy considering multisectoral and multilevel perspectives.

Conservation Through Consumption: Enhancing Biodiversity via Market Demand for Local Breeds in Croatia

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The current decline in biodiversity in various ecosystems requires urgent conservation measures, especially the preservation of indigenous breeds that have significant cultural and historical value. Native breeds are important genetic resources that contribute to biodiversity and cultural heritage, especially in the gastronomic sector. In the Republic of Croatia, the importance of indigenous breeds is recognised by the national authorities and breeders. However, despite this recognition, the population of these breeds is still small and some breeds are endangered. The valorisation of these breeds and their products is insufficiently developed, especially in terms of market offer and consumer recognition. The aim of this study is to analyse consumers' awareness and attitudes towards local breeds, their motivations for eating meat from these breeds and their recommendations for increasing market demand. The study is based on the concept of "conservation through consumption", which assumes that the consumption of endangered breeds can improve their conservation status. The objectives of the study are: • To assess consumer familiarity with local breeds. • To understand consumer attitudes towards local breeds. • To identify consumers' motivations for eating local breed meat. • To gather consumer recommendations for market preparation, including promotional and educational initiatives. To achieve these goals, an online survey of 435 consumers was conducted. Data was collected on consumers' familiarity with local breeds, their perceptions and attitudes towards these breeds, their eating habits and their suggestions for increasing the market presence of local breed products. The expected results of the study include a comprehensive understanding of the consumer perspective on local breeds, which can serve as a basis for strategies to increase market demand. This includes targeted promotional and educational campaigns that emphasise the value of local breeds for the conservation of biodiversity and cultural heritage. By linking market demand and conservation efforts, the study aims to contribute to the sustainability of local breeds and the ecosystems they support. This research has been fully supported by the Croatian Science Foundation (Genetic, Economic and Social Interactions of Local Breed Conservation Programs, GGD LocBreed), grant number IP-2020-02-4860

The situation of raw cow milk production on small-scale farms and agri-food chains in Hungary

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The quality of agricultural products as food ingredients is a very important factor. Errors in the production of raw materials cannot be corrected or can only be corrected at a considerable cost. Consumers expect food to be safe and want food of the right quality (nutritional value, taste, smell, etc.) for their money. The more developed a country's economy is, the more pronounced this demand becomes. Despite years of continuous quality improvement in the production of processed foods, consumers are becoming increasingly suspicious. This is due to several factors: oversupply in the food industry, greater difficulty navigating between foods, consumers' awareness of food scandals worldwide, the rapid increase in allergies, and consumers' health-conscious lifestyles, to name but a few. Quality testing is, therefore, an important task. This is also true for raw agricultural materials such as cow's milk. People have been consuming milk since time immemorial. Its importance has only increased with the development of scientific knowledge of nutrition, and its favourable composition and high and special nutritional value make it an important part of modern nutrition. In our study, we seek to answer the following questions: What are the quality and competitiveness characteristics of small-sized cow's milk farms in Hungary? How well do farmers have up-to-date information on quality control? What role can they play in meeting local demand? What specific products can they bring to the market? How can they be integrated into the supply chain? A mixed methodology will be used to answer these questions. In our secondary research, we will present the situation of the dairy sector in Hungary and its neighbouring countries, which are the most important from a market perspective, through a systematic literature review. Within the framework of our primary research, we will conduct semi-structured interviews with the managers of small-sized dairy farms in a given sub-region, with experts from the inspection authorities, and with members of the agricultural advisory network. The main findings of our study will be the results of our primary and secondary research.

Does drought pose a main challenge of farming in Tajikistan? The perception of small-scale farmers

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Prolonged droughts pose a significant risk to global agricultural production and food security. Tajikistan is one of the countries mostly affected by a drought occurrence. Despite the high vulnerability of a country to drought, the perception of local farmers of drought and barriers affecting small-scale farming remains under researched. Understanding farmers' views will facilitate designing of effective measurements and increase their acceptance and successful implementation. To examine perception of farmers, a questionnaire survey was conducted across three Tajik districts (Sugh, Khatlon, and Districts of Republican Subordination) in September 2023, involving 197 small-scale farmers. Surprisingly, the results indicated that only minimum (5%) of farmers considered sustained drought as a significant factor impacting production. Instead, issues such as inadequate irrigation infrastructure, limited land access, low soil fertility and productivity, soil degradation resulting from unsustainable land practices including overuse of chemicals or improper irrigation as well as market instability were identified as key challenges for small-scale farming in Tajikistan. This study underscores the importance of understanding farmers' perceptions in order to develop effective and sustainable solutions for farming. Improvement of irrigation systems, the enhancement of soil fertility through sustainable farming practices, the expansion of land access for small-scale farmers as well as stabilization of the market to ensure fair prices for farmers' produce should be considered by local policy makers.

Hydrological Balance for Sustainable Water Resources Management: Case Studies from the EWA-BELT Project

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The sustainable management of water resources is critical in addressing the challenges of climate change, population growth, and agricultural demands. Under the framework of the EWA-BELT project, the Thornthwaite-Mather model was performed to estimate the water balance in selected watersheds in the following countries: Ghana, Tanzania, Burkina Faso, and Kenya. This widely used model provides a framework for understanding how precipitation, evapotranspiration, and water storage in the soil interact over time within a defined geographic area. It helps assess whether a region is experiencing conditions of surplus, deficit, or equilibrium regarding its water resources from a geomorphological point of view. Data regarding land use, soil, geological conditions, GIS etc. (derived from the literature review and internet platforms), and available meteorological data (precipitation and temperature) were coupled to calculate the water balance in the examined basins. The prevailing conditions between the investigated East and West African countries are different. East African countries show lower temperature and higher precipitation. Also, geological formations are more permeable in East African case studies. The key findings are as follows: all case studies show water surplus. That means that on an intra-annual scale, at the end of the year, soil moisture reaches its maximum capacity, and an amount of water is stored in the aquifers and becomes runoff. East African countries (Kenya and Tanzania) case studies revealed a greater potential for water resources exploitation. In the case studies of these two countries, precipitation heights and infiltration percentages are higher, while evapotranspiration rates are relatively low compared to those of Ghana and Burkina Faso. This means that larger amounts of water resources could be used to cover demands for anthropogenic activities, mainly for irrigation purposes. The model's output can inform water resource management decisions, agricultural planning, and climate change impact studies. It is particularly useful in regions where water resources are critical and must be managed with an understanding of seasonal and inter-annual variability.

BioValue's achievement - recipes for new food dishes and innovative food products for promoting underutilized crops, dietary diversity, and sustainability

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The BioValue project adopts a demand-driven approach to develop new food dishes and innovative processed products incorporating biodiversity, with an emphasis on consumer appeal. The process involved evaluating new culinary products based on their organoleptic characteristics, nutritional value, and integration into consumers' daily diets. Through a bottom-up methodology, recipes for new food dishes were designed and their suitability for consumer preference was assessed. A comprehensive literature review was conducted to understand the nutritional properties and health impacts of novel foods. Subsequently, recipes are designed considering physicochemical properties, organoleptic characteristics, and nutritional aspects to create appealing and nutritious dishes. Sensory evaluations are then performed in several countries across Europe to optimize the sensory perception of the prototypes and assess their acceptability among consumers. In addition, through BioValue innovative food products based on underutilized crops were also created. Recipes for novel processed food products were designed using a bottom-up approach, considering nutritional characteristics, processing techniques, and consumer preferences. Initially, a comprehensive review explored the nutritional properties of selected underutilized plants and their preservation during processing, highlighting potential health benefits and methods to optimize nutritional quality. Recipe development focused on creating appealing and nutritious food options by considering physicochemical properties, organoleptic characteristics, and nutritional aspects. The usability and economic feasibility of the novel food products were then evaluated through production cost analysis and sensory evaluations, indicating their affordability, nutritional balance, and consumer acceptance. Sensory evaluations indicate the high acceptability of these dishes among consumers, suggesting their potential for market success. The major outcomes of this work include the BioValue Recipes booklets, containing detailed instructions and nutritional information for the newly created dishes and novel food products. In summary, the project integrates nutritional science, culinary expertise, and consumer preferences to promote underutilized crops, biodiversity, and sustainability in the food system.

A Comprehensive Cereal Supply Chain Quality Control and Decision-Making Framework (TraCEREAL)

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Cyprus faces a multitude of challenges related to food security, health, nutrition, and sustainability. These issues stem from factors such as a growing population, the impacts of climate change, water scarcity, and limited local food production, which result in a fragile cereal supply chain that is highly reliant on imports. This dependency makes the cereal supply chain susceptible to disruptions caused by external factors, and highlights the need for effective solutions to enhance its resilience. One potential strategy for bolstering resilience is to increase local cereal production and reduce reliance on imports. Blockchain technology, with its attributes of openness, decentralization, immutability, and distributed verification of digital transactions among stakeholders, emerges as an appealing solution to address the aforementioned limitations. These attributes guarantee the availability of precise, pertinent, and transparent information that can be further analyzed to derive insights and inform decisions. In the context of the food supply chain, blockchain technology enables adaptability, resilience, and recovery from external disruptions by ensuring the provenance and authenticity of data, ultimately facilitating more informed and strategic decision-making. The TraCEREAL project is dedicated to investigating how Blockchain technology, in conjunction with advanced IoT capabilities, can contribute to the establishment of resilient supply-chain operations within Cyprus. The project's objective is to develop and showcase a functional prototype system composed an intelligent algorithmic framework, seamlessly integrated with IoT technology, that can assist policymakers and industry stakeholders in constructing more resilient cereal supply chains tailored to the specific needs of Cyprus.

Addressing food security in a warming world - heat stress and nutritional impacts on wheat

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Introduction Wheat, a cornerstone of the global diet, significantly contributes to human nutrition by providing essential calories, phytate, iron, and zinc. However, the escalating challenge of climate change, particularly rising temperatures, threatens wheat production by inducing heat stress, which negatively impacts both crop yield and quality. Therefore, comprehending wheat's physiological responses to heat stress and its subsequent effects on nutritional content is of paramount importance. Methods This study focused on assessing the influence of heat stress on phytate and mineral contents, specifically iron and zinc, in wheat. Field experiments involving 1540 spring bread wheat genotypes were performed in Narrabri, located in north-western New South Wales. The minerals were quantified using an ICP-MS 8900, while phytate (IP6) levels were determined with a Dionex ICS5000. Results Heat stress resulted in a 9.3% decline in grain yield, a 15.8% decrease in thousand kernel weight, and a 12.7% reduction in plant height. Moreover, it accelerated the days to heading and maturity by 28.4% and 27.9%, respectively. Interestingly, heat stress elevated the concentrations of IP6 and most minerals, excluding Na and Ni. Specifically, IP6 and Mo levels surged by 42.6% and 43.1%, respectively, while Mn and Zn levels rose by 34.5% and 20.9%. Additionally, P, Fe, and Ca concentrations increased by 17.4%, 13.4%, and 14.3%, respectively, along with a 5.6% rise in protein content. The IP6/Fe ratio increased by 24.9%, and the IP6/Zn ratio by 16.9%. Conclusion Heat stress significantly affects wheat's agronomic traits and nutrition, resulting in higher levels of phytate and minerals but lower yields and reduced plant height. These changes pose serious implications for food security and human nutrition, particularly regarding the bioavailability of essential minerals like iron and zinc. As the global climate continues to warm, it is crucial to develop effective strategies to mitigate the adverse effects of heat stress on wheat production. Enhanced biofortification efforts and innovative agricultural practices are essential to ensure a stable and nutritious food supply in the face of climate change. Continued research is vital to support these endeavours and safeguard food security for future generations.

POS consumer behaviour towards defective food: a case study of beef with colour defects

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Beef is an essential part of the human diet, therefore, providing good quality of meat is of importance to consumers. Intrinsic beef quality traits depend to multiple factors such as the production system, feeding or welfare animal conditions. The antemortem stress of the animals leads to low muscle glycogen reserves, which alter the normal pH of the meat and consequently, which led to an increase in the occurrence of meat quality defects (discolouration, dark colour or bi-colouration). Dark Firm Dry (DFD) and Dark Cutting (DC) are one of the major meat quality defects associated with prolonged stress before slaughter. As a result, muscle pH does not decrease sufficiently and resulting in a dark coloured meat. The colour is the most important parameters in the final decision of consumers at the point of sale which can influence the consumer's purchasing decision and negatively impact their perception of the product. Meat is a highly perishable product and consumer rejection may lead to economic losses and the food wastage, contrary to the European zero waste policy. This study investigated the consumers' perception in the purchase decision of defective beef (DFD: pH>5.8; DC: 5,8 < pH24 < 6,2) versus control beef (nomal pH, pH<5.8) and how the application of a discount on defective meat (DFD and DC) influenced the choice. No differences were found due to gender or origin of the samples. In the case of the DC samples, they were chosen versus the control at the point of sale, but when the discount was applied, it was the DC samples that were chosen. In the case of DFD samples, they choiced predominantly the control samples with and without discount. In terms of meat evaluation, the control samples scored best. The evaluating consumer panel prefers control meat while in case of DC meat, the price discount influences the purchase decision. Consumer behaviour at the point of sale will allow the management of meat in the sales process in order to reduce wastage and take sustainable measures.

Food self-sufficiency of Western Balkan countries in the conditions of crisis

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The countries of the Western Balkans (Serbia, Bosnia and Herzegovina, Montenegro, North Macedonia, and Albania) are a group of countries classified in this category more for political than geographical reasons. It is a group of countries that aspires to membership in the European Union (EU). These countries are at a lower level of economic development than the EU countries. In recent years, these countries have not been bypassed by the financial crisis, the crisis caused by the COVID-19 virus, the migrant crisis, and the consequences of the conflict in Ukraine. In the conditions of the crisis, the agri-food sector is particularly threatened, and examining the degree of self-sufficiency is particularly important. For this reason, this research aims to assess the level of food self-sufficiency by estimating the situation in specific key segments of the agri-food sector. The research question is whether the Western Balkan countries can meet their food needs in crisis conditions and whether food security is threatened. In this direction, the methodology for the estimation of the revealed comparative advantages, as well as the self-sufficiency index, will be used. The UNComtrade and FAOstat database will be used for the period from 2008 to the last available year to cover the period of various crises. The expected results should show that Serbia, according to previous calculations and literature, has best results among these countries, given that for many years it has been the only one to achieve a surplus of foreign exchange of agri-food products and that it has the most developed agriculture and food industry of all the analyzed countries. The results should fill the gap in the literature regarding this topic, but also guide the creators of agricultural policy in which direction support should be directed, so that food security is not threatened in crises.

Exploring young consumers' willingness to pay for edible takeaway coffee cups

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The surge in environmental awareness among young consumers has fueled demand for sustainable alternatives in the food and beverage industry. One such innovation is the edible takeaway coffee cup, offering an eco-friendly solution by reducing waste and providing a unique consumption experience. This study aims to estimate the willingness to pay (WTP) for edible takeaway coffee cups among young consumers and explore the socioeconomic factors influencing WTP. We conducted a survey with 827 young takeaway coffee consumers using the Google Forms platform. The questionnaire gathered demographic and socioeconomic information, as well as insights into consumers' familiarity with edible products and potential adoption barriers. To uncover willingness to pay, we employed the contingent valuation method (CVM) and utilized an interval regression model due to the nature of the dependent variable. Anticipated results suggest a strong preference among young consumers for edible takeaway coffee cups, with a significant proportion willing to pay a premium for these eco-friendly alternatives. The average willingness to pay is expected to surpass the cost of traditional disposable cups. Additionally, we anticipate that females will exhibit a higher willingness to pay a premium compared to males. Furthermore, based on existing literature, higher income levels are likely to correlate positively with willingness to pay. Among the barriers to adoption, we expect price sensitivity and taste preferences to emerge. In conclusion, while there is considerable market potential for edible takeaway coffee cups among young consumers, addressing concerns regarding affordability and taste will be critical to their success. Strategic marketing and educational campaigns are essential to enhance consumer acceptance and willingness to pay. This study contributes to understanding the market dynamics of sustainable food packaging and offers insights for stakeholders seeking to promote eco-friendly innovations.

Improving food reuse in the supply chain: Spanish consumers' behaviour and perceptions towards beef with colour defects through Focus Groups

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At the time of purchase, different variables are taken into account by the consumer, such as the price he can afford to pay or the convenience provided by packaging. However, when purchasing beef, the consumer values above all the colour of the meat. The most important factor that can alter the colour of beef is antemortem stress, which will be determined by the pH of the meat. The final pH of beef is around 5.8, an optimal pH considered normal. Antemortem stress is caused among other reasons by breed, gender, age, diet, rearing, and in particular, by transport conditions, and time spent in the depot of slaughterhouse immediately before slaughter. Beef's pH, due to this fact, can affect the colour and therefore, at the point of sale, consumers may find packaged meat which is perfectly edible but that present an unusual colour (darker). Consequently, consumers often refuse to buy and therefore consume this beef, with the economic (loss of revenue) and environmental (resources used to produce the meat are wasted) effects. Within this context, a qualitative study was carried out in Spain in order to delve into the behaviour and perceptions of Spanish consumers towards purchasing and consuming beef with colour defects. To this aim, 6 focus group sessions were carried out in different Spanish regions where meat is produced and regularly consumed. This study highlights the importance of understanding beef consumer attitudes and acquire knowledge about the reasons for beef consumption. Other aspects such as the intensity of consumption, the identification of product quality characteristics or the place of purchase have also been found relevant regarding consumers purchasing behaviour. Furthermore, our research points out that information provided to consumers can also be relevant to shape consumer purchasing behaviour, as they may learn that the product offered, although with unusual features (colour) is totally wholesome and nutritious. This research highlights opportunities regarding the reuse of foods that, although not perfect according to commercial standards, can be sold and consumed with no limitations, which will contribute to the fulfilment of economic and environmental objectives of the agri-food sector.