Behavioral and Experimental Economics for Policy Design in the Water–Energy–Food Nexus: A Systematic Review of Methods and Applications

Angelica De Fabrizio[1]*, Felipe Micangeli[1], Nicole Bernoni[2]

Abstract

Achieving universal access to safe water, reliable energy, and food security remains a global challenge, yet policy interventions often target these domains in isolation. While the Water-Energy-Food (WEF) Nexus provides a theoretical framework for resource integration, experimental evidence on behavioral interdependencies remains fragmented. This study conducts a systematic review of 37 experimental and behavioral economics articles evaluating interventions in developing and resource-scarce contexts to analyze methodological approaches and outcomes across the three sectors. Our findings reveal significant heterogeneity: Randomized Controlled Trials dominate the energy and food sectors, focusing primarily on technology adoption and subsidy effectiveness, whereas lab-in-the-field experiments are more prevalent in the water sector, emphasizing common-pool resource governance and collective action. Despite robust evidence that behavioral nudges and financial incentives boost short-term adoption and willingness to pay, the WEF Nexus remains tacit in experimental designs. Most studies treat inter-sectoral linkages as background conditions rather than central variables, missing potentially significant spillover effects between the three domains. We conclude that a transition toward "Nexus-aware" experimental designs is possible, utilizing joint metrics and longitudinal monitoring.

JEL Classification: C93; D91; O13; Q01; Q25

Keywords

Water-Energy-Food Nexus — behavioral economics — experimental economics — policy analysis

[1] *Department of Economics and Law, Sapienza University of Rome, Italy*
[2] *ITA – Italian Trade Agency, Italy*
***Corresponding author**: angelica.defabrizio@uniroma1.it

Introduction

Achieving universal access to safe water, reliable energy and food security are between major global challenges each being the focus of one of the UN Sustainable Development Goals (UN, 2015). The Water-Energy-Food (WEF) Nexus is a conceptual and operational framework that recognizes the interconnections between water, energy, and food systems and the need to consider these interdependencies in an integrated manner to promote sustainable and resilient development (Bazilian et al., 2011). This approach stems from the awareness that isolated sectoral policies, which treat water, energy, or food in silos, are unable to respond to the complexity of global and local dynamics, especially in a world characterized by population growth, urbanization, climate change, and scarcity of natural resources. The concept of a WEF Nexus was formalized in Bonn 2011 conference, and formed a substantial contribution to Rio 2012 UN Conference on Sustainable Development, where the need for an integrated framework to address global resource challenges was recognized. International organizations subsequently adopted this approach and its relevance in the field of sustainable development has been acknowledged by many studies in the literature over recent years (Bazilian et al., 2011; Albrecht et al., 2018; Sušnik and Staddon, 2022; Apeh and Nwulu, 2024; Zama et al., 2025).

The WEF Nexus is based on the principle that the availability, production, and use of each of these three resources directly affect one another. At the heart of this interconnection are water and energy, which constitute the invisible infrastructure on which all other productive and social systems rely. Access to safe water and its sustainable management are explicitly addressed by SDG 6, but the role of water goes far beyond this single goal. Water is an essential input for energy production, agriculture, public health, and the functioning of ecosystems. Closely linked to water is the energy dimension, central to SDG 7, which aims to ensure access to reliable, sustainable, and affordable energy for all. Energy is fundamental for the extraction, treatment, and distribution of water, as well as for the production, processing, storage, and distribution of agricultural products. Food security, focus of SDG 2, arguably represents the tightest point of convergence between the productive uses of water and energy for development. Agricultural production is, in fact, the most water-intensive sector and one of the largest users of energy, both directly and indirectly (UNESCO, 2025).

Experimental economics has become an established and widely-applied methodology for evaluating development pro-

grams and policy interventions targeting household behavior, resource management, and technology adoption (Mousavi et al., 2017; Reijula et al., 2018; Gil-Gallen and Maltese, 2023). Building on foundational work by Nobel laureates Banerjee and Duflo (2009) on randomized controlled trials in development contexts, behavioral and experimental approaches have proliferated across safe water, energy access, and food security domains. However, this rich experimental literature remains largely siloed by sector, with few studies explicitly examining how behavioral mechanisms and policy interventions interact across the water, energy, and food systems.

Sušnik and Staddon (2022) highlighted that integrating experimental social science techniques with quantitative modeling and local stakeholder engagement is critical to the success of WEF Nexus programs. Understanding the complementarities and trade-offs between behavioral interventions across the three domains of the nexus is essential for designing more effective and coherent WEF Nexus programs that leverage behavioral insights to address resource interdependencies.

This review systematically examines behavioral and experimental economics studies evaluating interventions for sustainable water availability and management, reliable energy access, and food security in developing or resource-scarce contexts, identifying methodological complementarities and gaps across the WEF Nexus. We categorize the existing literature within each domain by intervention type, experimental design, and observed outcomes.

Our analysis reveals significant heterogeneity in research practices and a pervasive neglect of inter-domain spillover effects. We argue that methodologies successfully applied to social interactions in water governance—such as collective action games—could be fruitfully extended to community-based energy access interventions. Ultimately, we advocate for a transition toward 'Nexus-aware' experimental designs that explicitly account for inter-sectoral spillovers and utilize integrated WEF Nexus metrics to capture resource interdependencies.

Methodology

The review was performed according to the PRISMA method (Moher et al., 2009).

Search Strategy

A systematic review of the international literature on Water, Energy, and Food-related policies in developing contexts was conducted in four electronic databases (Scopus, Google Scholar, Science Direct, and Mendeley).

The focus of the search was to identify interventions that were experimentally evaluated with original data regarding safe water access, reliable energy, and/or food security in developing contexts. Experimental and behavioral studies analyzing interventions regarding access or conservation of water, energy, and food in resource scarcity contexts in OECD countries were considered as well.

This search included all possible combinations of two keyword blocks of terms such as "drinking water", "water management", "energy access", "rural electrification", "clean cooking", "food security", "food poverty", "sustainable agriculture", "behavioral economics", "experimental economics", "field experiment", "randomized experiment", "RCT", "nudge". Additional eligible articles were identified by checking the reference lists of the articles that met the inclusion criteria.

Inclusion criteria

The selected studies were eligible if they met the following inclusion criteria: (1) they had to have used experimental or behavioral economic methodologies according to Harrison and List (2004) to study interventions related to either water, energy or food in developing or resource-scarce contexts (2) they had to have analyzed originally collected data, (3) they had to have been written in English

Selection process

After searching a database for relevant articles, the identified articles were merged in order to identify and delete duplicates. The screening process was completed in two steps. The relevant articles were initially screened for eligibility based on their titles and abstracts. Then, full-text articles were further studied for eligibility and checked that the above-mentioned inclusion criteria were satisfied (see Fig.1).

Results

A total of 142 articles were initially identified across the water, energy, and food domains of the Nexus. Following the removal of duplicates ($n = 4$), the remaining records underwent title and abstract screening, resulting in the exclusion of 77 articles deemed non-relevant—primarily those originating from the medical or engineering fields. Of the 61 full-text articles assessed for eligibility, 24 were excluded for failing to meet the inclusion criteria, specifically because they lacked focus on developing or resource-scarce settings or because they lacked original data analysis. Consequently, 37 articles were selected for inclusion in this systematic review. The detailed selection process is illustrated in the PRISMA flowchart (Fig. 1).

Water

Table 1 presents the main characteristics of the included studies regarding the water domain.

Interventions

In the field of water research, experimental studies primarily focus on three types of interventions: social-norm nudges, institutional cooperation mechanisms, and market-based or technology-adoption-oriented instruments. Each of these types of interventions targets individual or collective choice under conditions of scarcity, providing a framework for comparative analysis.

Among the nudging interventions in our water-sector sample, social-norm approaches are the most common. Examples include providing comparative feedback on water use or individual water footprint information. These interventions tend to deliver the most immediate results. They have consistently produced short-term reductions in water consumption.

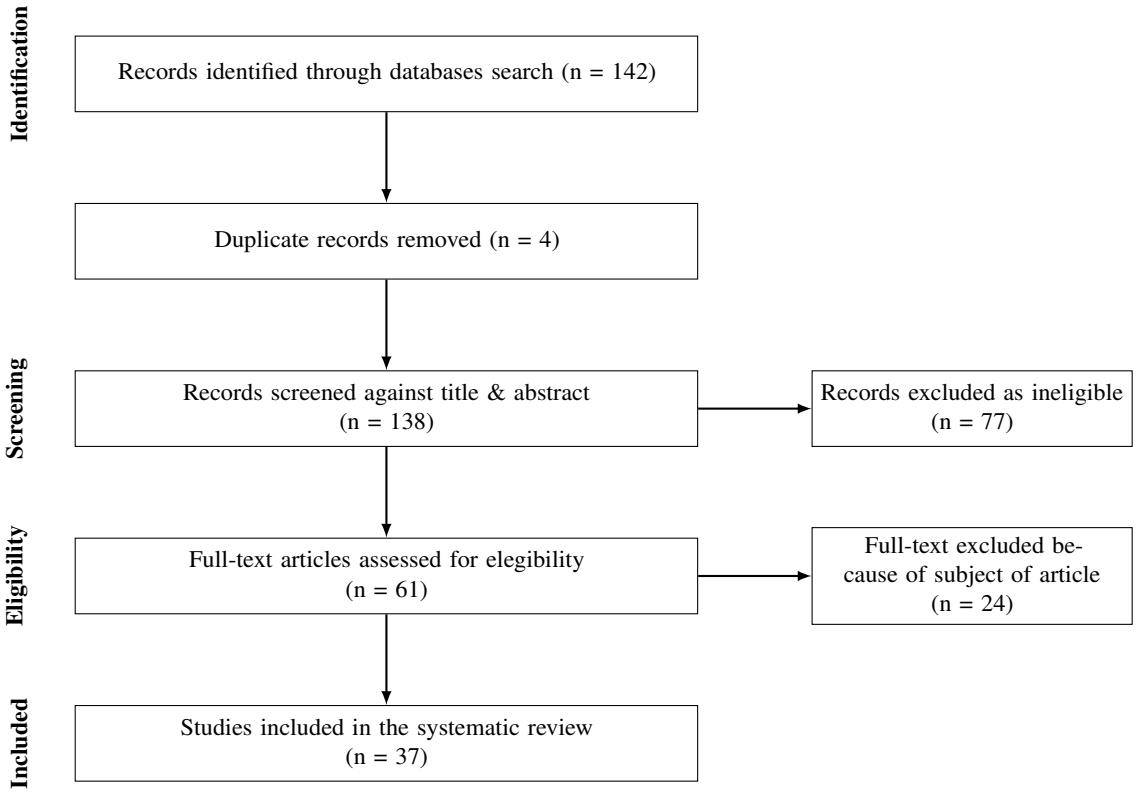

Figure 1. PRISMA flow diagram of the study selection process following Moher et al. (2009).

This is seen in randomized trials with urban households in African contexts (Brick et al., 2023) and in field experiments in China testing different social-comparison framings (Wang et al., 2025). Other nudging mechanisms in the sample, such as marketing-based strategies (Luoto et al., 2014) and disruptive cues (Naluonde et al., 2019), target different behavioral levers. These show mixed evidence on persistence. Clarifying these distinctions is important. While social-norm nudges dominate the reviewed sample, evidence on their long-term effectiveness remains limited. Behavioral changes often diminish once feedback or comparison cues are removed.

A second strand of the literature focuses on institutional and cooperative mechanisms, particularly rule-setting and transparency about others' behavior. Laboratory and field experiments have shown that enabling users to design rules collaboratively or observe peer actions increases compliance and fosters collective action (Janssen et al., 2015; Ibele et al., 2017). These effects are particularly pronounced in lab-in-the-field settings that closely resemble real water governance challenges. For example, water games conducted with local communities in Latin America highlight processes of social learning and coordination that go beyond individual incentives (Bernal-Escobar et al., 2025).

Market-based instruments and information campaigns aimed at increasing willingness to pay or introducing new technologies have shown mixed results. In controlled environments, carefully designed trading rules have been shown to improve allocation efficiency and increase willingness to pay (Murphy et al., 2000; Broadbent et al., 2014). Field evidence is more context-dependent. Information campaigns in Tunisia and Vietnam increased the willingness to pay for irrigation services and wastewater treatment (Farolfi et al., 2018; Lampach et al., 2023), while programs combining marketing with behavioral nudges successfully promoted household water treatment technologies in Kenya and Bangladesh (Luoto et al., 2014).

Experimental designs

Experimental research in the water sector employs a balanced approach, integrating rigorous scientific methods with a focus on real-world relevance. Randomized controlled trials are mostly applied to evaluate short-run nudges and adoption programs at the household level, often demonstrating that social feedback can reduce water use in the short term. Lab-in-the-field experiments, while also capable of estimating peer effects, add value by situating interventions in governance settings and capturing repeated interactions and institutional dynamics. Evidence from irrigation games and community-based studies shows that transparency, social comparison, and co-designed rules can strengthen cooperation and promote more equitable water allocation. These designs reveal social learning processes beyond individual incentives (Janssen et al., 2015; Bernal-Escobar et al., 2025; Wang et al., 2025; Naluonde et al., 2019).

While laboratory experiments are characterized by heightened control and a focus on mechanisms such as market design or rule formation, they differ in their application to real-world settings and in their ability to yield actionable insights. Their insights are valuable for understanding specific processes, but they have limited applicability to real-world contexts (Mur-

Table 1. Characteristics of the included studies regarding the Water domain.

Author, Year	Purpose	Region	Intervention	Methodology	Outcome
Abbink et al. (2010)	To investigate whether non-binding contracts for seasonal water releases can foster cooperation and overcome mistrust in a laboratory experiment simulating the Syr Darya river conflict between Kyrgyzstan, Uzbekistan, and Kazakhstan.	Asia	Interstate coop. agreement	Lab Experiment	Behavior & Social Interactions
Asprilla-Echeverria (2024)	To examine whether information on reduced water quantity or time to aquifer exhaustion can influence farmers' willingness to cooperate by conforming to extraction caps in adapting to water scarcity in Colombia.	Latin America	Info Campaign	Lab-in-the-field	Behavior & Social Interactions
Bernal-Escobar et al. (2025)	To investigate whether field water games can promote social learning to enhance collective action and cooperation in water management among participants in Colombia.	Latin America	Training, peer exposure	Lab-in-the-field	Behavior & Social Interactions
Brick et al. (2023)	To investigate whether delivering social-norms nudges—information on peer water use—can influence household water conservation behaviors in South-African communities.	Africa	Nudging	RCT	Behavior & Social Interactions
Broadbent et al. (2014)	To explore whether functioning water-leasing markets—facilitated in a laboratory setting—affect allocation efficiency and policy viability in North American agricultural water contexts.	North America	Price Change	Lab Experiment	Equity, Gov & Policy
Farolfi et al. (2018)	To determine whether an information campaign—providing institutional and peer-related details—can influence farmers' willingness to pay for irrigation water in Tunisian agricultural associations.	Africa	Info Campaign	Lab Experiment	Technology Adoption & Access
Ibele et al. (2017)	To assess whether different rule-setting frameworks—endogenous versus exogenous—impact cooperation levels in water management through cross-country laboratory experiments in European contexts.	Europe	Policy framework	Lab Experiment	Behavior & Social Interactions
Janssen et al. (2015)	To examine whether providing detailed information—on others' investments and earnings—in a behavioral irrigation game influences cooperation and equity in North American lab-in-the-field experiments.	North America	Info Campaign	Lab-in-the-field	Behavior & Social Interactions
Kecinski and Messer (2018)	To investigate whether framing and information provision about recycled versus conventional irrigation water affects consumer willingness to pay for produce in a North American field-experiment context.	North America	Info Campaign	Lab-in-the-field	Adoption, Behavior
Koundouri et al. (2025)	To assess whether integrating experimental economics with living-lab stakeholder engagement promotes adoption of urban drinking water systems and guarantees access in European water management.	Europe	Policy framework	Living Labs	Technology Adoption & Access
Lampach et al. (2023)	To determine whether a discrete-choice information campaign can influence handicraft enterprises' willingness to pay for wastewater treatment to reduce ecological and health risks in Vietnam's Red River Delta.	Asia	Info Campaign	Lab-in-the-field	Technology Adoption & Access
Luoto et al. (2014)	To explore whether marketing and behavioral-economics nudges increased consistent adoption of point-of-use water treatment in randomized field trials across Kenya and Bangladesh.	Africa	Nudging, Info	RCT	Technology Adoption & Access
Murphy et al. (2000)	To test whether laboratory-based "smart" water market institutions can improve efficiency, willingness to pay, and demand-response adoption under drought-like conditions in North America.	North America	Market, Demand-resp.	Lab Experiment	Technology Adoption & Access
Naluonde et al. (2019)	To evaluate whether introducing a disruptive cue—soap-on-a-rope—can incentivize and sustain handwashing behavior among schoolchildren in a lab-in-the-field experiment in Zambia.	Africa	Nudging	Lab-in-the-field	Behavior & Social Interactions
Wang et al. (2025)	To examine whether different types of social comparison messages—varying spatial groups, monetary framing, and historical context—affect urban Chinese residents' water-saving behavior in a field experiment.	Asia	Social norms	Lab-in-the-field	Behavior & Social Interactions

phy et al., 2000; Broadbent et al., 2014). More recent hybrid approaches, such as European *Living Labs*, aim to combine experimental control with stakeholder engagement, testing technology adoption and governance interventions in urban and community environments. Living Labs are experimental platforms that combine technological testing with stakeholder involvement in real-world contexts (Koundouri et al., 2025).

Outcomes

Key outcomes examined across studies include water consumption, cooperation, willingness to pay, and technology adoption. Research indicates that social-norm nudges result in modest yet statistically significant reductions in water usage among both households and farmers (Brick et al., 2023; Wang et al., 2025). These effects are consistently observed in the short term, but evidence on persistence remains scarce, representing a structural weakness of this literature.

The outcomes of cooperation demonstrate greater improvements when rules are determined by the individuals involved or when information about others' actions is made available. According to experimental studies, these conditions have been shown to result in higher compliance and more equitable resource allocation (Janssen et al., 2015; Ibele et al., 2017).

Table 2. Characteristics of the included studies regarding the Energy domain.

Author, Year	Purpose	Region	Intervention	Methodology	Outcome
Aklin et al. (2017)	To investigate whether a solar micro-grids electrification program is effectively improving affordability and energy access in Uttar Pradesh, India.	Asia	Electrification	RCT	Technology Adoption & Access
Archambault et al. (2016)	To examine whether peer effects can increase voluntary contributions to community-based electrification projects in Kenya.	Africa	Social Learning	Lab-in-the-field	Behavior & Social Interactions
Bensch and Peters (2020)	To determine whether one-time free distribution can increase the willingness to pay for clean cooking technology in Senegal.	Africa	Subsidy	RCT	Technology Adoption & Access
Bernard and Torero (2015)	To test for the presence of social interaction effects on neighbor households' decision to connect to a newly installed electrical grid in rural Ethiopia.	Africa	Electrification	RCT	Behavior & Social Interactions
Foster et al. (2018)	To evaluate the effectiveness of electricity subsidy elimination, reduction, and decoupling on groundwater extraction behavior using a field experiment with Mexican farmers and laboratory comparisons.	Latin America	Subsidy	Lab-in-the-field	Technology Adoption & Access
Grimm et al. (2020)	To analyze whether price and payment period changes affect technology adoption and willingness to pay for off-grid energy systems in rural Rwanda.	Africa	Price Change	RCT	Technology Adoption & Access
Kamanyire et al. (2024)	Using a modified public goods game to investigate whether electricity access can reduce bargaining bias and empower women in rural Uganda.	Africa	Electrification	Lab-in-the-field	Well-being & Dev
Lee et al. (2020)	To evaluate whether improved electricity access through national grid expansion can affect consumption and socio-economic development in Kenya.	Africa	Electrification	RCT	Adoption, Well-being
Mekonnen et al. (2023)	To study whether information campaigns and subsidies influence willingness to pay and technology adoption of energy systems in Ethiopia.	Africa	Subsidy	RCT	Technology Adoption & Access
Meriggi et al. (2021)	To examine whether subsidies for solar lamps can drive technology adoption and willingness to pay beyond the initial sample of beneficiaries through social learning.	Africa	Subsidy	RCT	Behavior & Social Interactions
Rains and Abraham (2018)	To assess whether incentives to collect energy bills can increase public service provision and therefore improve energy access in Bihar, India.	Asia	Incentives	RCT	Technology Adoption & Access
Schuch et al. (2025)	To investigate the role of dishonesty, poverty and social norms in small-electricity theft, being it a major barrier to expanding energy access in Colombia.	Latin America	Social Learning	Lab-in-the-field	Behavior & Social Interactions
Wong et al. (2022)	To determine whether subsidies through vouchers can increase microsolar adoption and affordability in Uttar Pradesh, India.	Asia	Subsidy	RCT	Technology Adoption & Access

However, the magnitude of these effects varies substantially across contexts. The evidence that transparency can contribute to fairer outcomes and more equitable distributional impacts is rarely examined systematically (Janssen et al., 2015).

Energy

Table 2 presents the main characteristics of the included studies regarding the energy domain.

Interventions

Research in this field is grouped into three categories: incentives for technology adoption and access, nudging and social norms, and pricing or demand-response mechanisms. Most evidence centers on technology adoption and access. Randomized controlled trials in African and Asian contexts show that subsidies increase uptake of solar home systems and electrification technologies by reducing upfront costs and easing liquidity constraints (Bensch and Peters, 2020; Meriggi et al., 2021; Wong et al., 2022). Improved access to electricity is linked to better household welfare and greater local economic activity, though the size of these effects varies by context (Lee et al., 2020). One limitation is that these studies often focus on specific regions or populations, limiting broad generalizations across different global contexts.

A smaller but growing body of literature studies nudging, training, and social-norm interventions to promote cooperation and voluntary contributions in energy provision. African studies show that peer behavior and social nudges boost collective investment and trust in shared energy systems (Archambault et al., 2016). Evidence from Latin America shows that norm-based interventions reduce electricity theft and improve cooperation, addressing governance failures beyond consumption issues (Schuch et al., 2025). Demand-response mechanisms can also improve reliability in community-based systems (Grimm et al., 2020; Avordeh et al., 2025). Research suggests that, when paired with electrification, behavioral interventions can reduce intra-household bargaining bias and support women's empowerment (Kamanyire et al., 2024). These findings show that energy interventions may affect social dynamics beyond energy metrics. In summary, subsidies and access-oriented programs reliably boost adoption, while nudges and social norms are effective for behavioral and governance barriers.

Experimental designs

Experimental research in the energy sector uses randomized controlled trials, lab-in-the-field experiments, and case studies to provide clear insights. RCTs are the main method for

evaluating subsidies and electrification programs, showing that financial incentives reliably increase adoption and affordability of solar and electrification technologies (Bensch and Peters, 2020; Meriggi et al., 2021; Wong et al., 2022). While RCTs excel at establishing causal relationships, they often provide less insight into broader water–energy–food interactions and may struggle with generalizability.

Lab-in-the-field experiments situate interventions within community and institutional contexts. In African and Latin American studies, nudges and training have been shown to increase cooperation, voluntary contributions, and trust, while social-norm interventions impact electricity theft (Archambault et al., 2016; Schuch et al., 2025). Some research links electrification and behavioral programs to reduced intra-household bargaining bias and greater women's empowerment (Kamanyire et al., 2024).

Hybrid designs, such as demand-response tests, integrate lab-in-the-field and case study methodologies to combine experimental rigor with broader system perspectives (Avordeh et al., 2025). Although experiments are valuable for capturing longer-term socio-economic impacts, they often do so at the expense of causal precision (Ghosh et al., 2026). While RCTs are essential for measuring adoption, lab-in-the-field and hybrid designs yield a deeper understanding of governance and social dynamics.

Outcomes

The literature on energy access consistently demonstrates that the most significant short-term impacts occur in technology adoption and affordability. Empirical evidence confirms that targeted subsidies effectively drive the uptake of solar and electrification technologies (Foster et al., 2018; Bensch and Peters, 2020; Meriggi et al., 2021; Wong et al., 2022). Notably, Foster et al. (2018) evaluate groundwater extraction levels among Mexican farmers under alternative electricity subsidy schemes; in doing so, they de facto address the Water–Energy–Food Nexus, despite the absence of an explicit theoretical reference to the framework.

Expanded energy access is associated with improved household welfare and greater local economic activity (Lee et al., 2020). Pricing interventions affect willingness to pay and demand, though their impact varies significantly across income levels (Grimm et al., 2020).

Behavioral interventions yield important social outcomes: nudges and training increase cooperation and voluntary contributions to shared energy infrastructure (Archambault et al., 2016), while social norms interventions reduce electricity theft and enhance trust in energy providers (Schuch et al., 2025). Gender-sensitive electrification initiatives also reduce intra-household bargaining bias and increase women's empowerment (Kamanyire et al., 2024).

Food

Table 3 presents the main characteristics of the included studies regarding the food domain.

Interventions

Behavioral interventions in the food sector focus on food security and agricultural improvements. Interventions can be classified into four main categories: nudging strategies that influence choices and willingness to pay, monetary and non-monetary incentives, information provision and training, and market-based approaches that promote cooperation.

In African contexts, nudging interventions, sometimes combined with incentives, have been shown to increase willingness to pay. These strategies also affect adoption decisions among both producers and consumers (Balew et al., 2023; Okello et al., 2023). Information-based experiments similarly influence willingness to pay by addressing timing and liquidity constraints (Duflo et al., 2011).

Peer effects frequently amplify these outcomes, indicating that social diffusion may help resolve coordination failures in local markets (Balew et al., 2023; Okello et al., 2023). In Asian settings, nudging interventions influence food choice behavior by addressing behavioral and informational constraints, although they do not directly assess technology adoption (Davidson et al., 2021). In Europe, framing-based nudges consistently alter choices and stated preferences, even in the absence of financial incentives (Chabé-Ferret et al., 2019).

Information campaigns typically increase willingness to pay by correcting misconceptions, with their effectiveness contingent upon message credibility and trust (Farolfi et al., 2018). Market-oriented interventions that alter cooperative structures improve supply chain coordination (Solano-Hermosilla et al., 2022). Additionally, interventions that enhance access to resources can accelerate technology adoption in agriculture (Buck and Alwang, 2011).

Experimental designs

Methodologically, empirical research in the food sector primarily relies on Randomized Controlled Trials (Davidson et al., 2021; Buck and Alwang, 2011; Bulte et al., 2014; Chabé-Ferret et al., 2019; Solano-Hermosilla et al., 2022; Duflo et al., 2011), lab-in-the-field experiments (Balew et al., 2023; Okello et al., 2023), and laboratory experiments (Farolfi et al., 2018). RCTs provide high internal validity for sector-specific outcomes, including food choice behavior and technology adoption. However, they frequently neglect cross-sector spillovers between water and energy, which limits their relevance to the WEF Nexus Buck and Alwang (2011); Davidson et al. (2021).

Lab-in-the-field designs effectively capture social norms and peer dynamics, though they typically rely on short observation periods Balew et al. (2023); Okello et al. (2023). Laboratory experiments can precisely isolate mechanisms such as framing effects, but they exhibit limited ecological validity when applied to real-world food systems Farolfi et al. (2018); Chabé-Ferret et al. (2019).

Outcomes

The literature consistently documents increased willingness to pay and shifts in choices toward improved practices following nudges and incentives. These changes are frequently mediated by social learning Balew et al. (2023); Okello et al. (2023). In Asia, nudging interventions influence food choice and dietary

Table 3. Characteristics of the included studies regarding the Food domain.

Author, Year	Purpose	Region	Intervention	Methodology	Outcome
Balew et al. (2023)	To examine whether nudging and incentives can affect willingness to pay and peer effects in Ethiopian food markets.	Africa	Nudging, Incentives	Lab-in-the-field	Behavior, Adoption
Buck and Alwang (2011)	To determine whether improved access to food resources can drive technology adoption in Ecuador agricultural settings.	Latin America	Food Security	RCT	Technology Adoption & Access
Bulte et al. (2014)	To examine whether nudging through framing effects can influence behavioral responses in Tanzania water and food contexts.	Africa	Nudging	RCT	Behavior & Social Interactions
Chabé-Ferret et al. (2019)	To explore whether nudging and training interventions can influence water systems and technology adoption in South-West France.	Europe	Nudging, Info	RCT	Adoption, Behavior
Davidson et al. (2021)	To evaluate the effectiveness of nutrition-focused behavioral workshops and nudging on diet quality in Bangladesh using a Randomized Control Trial.	Asia	Nudging	RCT	Behavior & Social Interactions
Duflo et al. (2011)	To examine how small, time-limited fertilizer incentives can increase adoption among farmers and improve food security in Kenya.	Africa	Info Campaign	RCT	Technology Adoption & Access
Ghosh et al. (2026)	To analyze how water hyacinth biogas can enhance food systems via fertilizer production and improved household food access in West Bengal.	Asia	Info, Training	Lab-in-the-field	Adoption, Well-being
Okello et al. (2023)	To study how social incentives affect seed adoption, with implications for improving food security in Ugandan markets.	Africa	Nudging	Lab-in-the-field	Adoption, Behavior
Solano-Hermosilla et al. (2022)	To investigate how behavioral nudges affect participation in food price crowd sourcing, showing that social norms boost engagement and offering insights in Nigeria's food systems.	Africa	Market	RCT	Behavior & Social Interactions

decisions Davidson et al. (2021). In Europe, experimental evidence indicates that a combination of framing and information provision affects willingness to pay, behavioral responses, and technology adoption Chabé-Ferret et al. (2019).

RCTs demonstrate significant improvements in technology adoption when interventions reduce access barriers or address behavioral constraints (Buck and Alwang, 2011; Chabé-Ferret et al., 2019). Framing-based nudges primarily influence behavioral responses, with limited impact on productivity (Bulte et al., 2014).

Productivity gains are generally mediated by the adequacy of complementary inputs (Duflo et al., 2011; Bulte et al., 2014). Although interventions that promote trust and social capital enhance coordination, their links to standardized environmental indicators, such as ecological footprints, are rarely established (Solano-Hermosilla et al., 2022). Moreover, the long-term persistence of these effects remains insufficiently explored, as most studies emphasize short-term outcomes (Chabé-Ferret et al., 2019; Farolfi et al., 2018; Davidson et al., 2021).

Discussion

The systematic analysis reveals a stark methodological dichotomy that limits the applicability of current behavioral economics to the WEF Nexus. While the Water sector has cultivated a mature tradition of utilizing Lab-in-the-Field experiments to address common-pool resource dilemmas (Janssen et al., 2015; Bernal-Escobar et al., 2025; Asprilla-Echeverria, 2024; Koundouri et al., 2025; Ibele et al., 2017), the Energy and Food sectors remain dominated by Randomized Controlled Trials focused on technology adoption and ex-post impacts (Duflo et al., 2011; Aklin et al., 2017; Bensch and Peters, 2020; Buck and Alwang, 2011; Bernard and Torero, 2015; Grimm et al., 2020; Lee et al., 2020; Mekonnen et al., 2023; Meriggi et al., 2021; Rains and Abraham, 2018; Solano-Hermosilla et al., 2022; Wong et al., 2022). This divergence is not merely methodological but conceptual: Energy and Food are predominantly treated as private goods, where the primary behavioral barrier is liquidity or information. In contrast, Water is treated as a shared resource governed by social norms and collective action.

This compartmentalization is problematic because it obscures the "commons" nature of the other two sectors. As developing regions transition toward community-based microgrids and peer-to-peer energy trading, the stability of energy systems increasingly resembles a common-pool problem. Consequently, the Energy sector's reliance on RCTs—which excel at measuring individual uptake but struggle to capture social dynamics—represents a critical blind spot. There is a significant, yet unexploited, opportunity for cross-sectoral synthesis: the experimental game protocols used to study irrigation governance could be effectively adapted to decentralized energy systems to reveal the social capital and rule-setting mechanisms required for success. Until these methodologies cross-pollinate, the WEF Nexus will remain a "conceptual ghost" in experimental design: frequently invoked in theory as an interconnected system, but empirically measured as three isolated silos.

Conclusion

This review demonstrates that while experimental economics has successfully identified sector-specific behavioral levers—such as the role of subsidies in technology adoption or social pressure in water conservation—it has largely failed to operationalize the interdependencies of the Water-Energy-Food Nexus. The current literature lacks the joint metrics required to capture the cognitive and material spillovers that occur when an intervention in one domain inadvertently alters incentives in another.

To move beyond sectoral isolation, future research must transition toward "Nexus-aware" experimental designs. This

necessitates a move away from single-outcome RCTs toward integrated protocols that utilize multi-sector indicators to simultaneously track energy reliability, water consumption, and food security outcomes. Furthermore, researchers must prioritize longitudinal follow-up periods to assess whether behavioral nudges in one sector sustain their efficacy when resource constraints in another sector fluctuate. Only by explicitly modeling these cross-sectoral spillovers can policy interventions be designed to exploit Nexus synergies rather than exacerbating hidden trade-offs.

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