TRADE4SD

Fostering the positive linkages between trade and sustainable development

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Do Different Local Institutional Arrangements Matter for Farmers and Traders' Engagement in Sustainable Practices: Results from Lab in the Field Experiments

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About TRADE4SD Project

Trade policy is a central factor in shaping global, regional and local development. It has an especially important part to play in achieving the UN Sustainable Development Goals (SDGs). The starting point of the TRADE4SD project is that trade has the power to produce positive and sustainable outcomes when the policies, which define the rules of the game, are framed and designed in a way to promote access to markets, fair prices and standards of living for farmers, as well as alleviating rural poverty and ensuring sustainable farming practices. Addressing the relation between trade and SDGs requires an integrated approach to policy-making and inclusive governance.

The main objective of the TRADE4SD project is to contribute to build new opportunities for fostering the positive sustainability impacts of trade supported by improved design and framing of trade policy at national, EU and global level, including WTO modernisation, increased policy coherence at different domains including agricultural, energy, climate, environmental and nutritional policies. To meet this objective, the project develops an integrated and systematic approach that combines quantitative models from different perspectives, and several qualitative methods recognising that SDGs and trade are highly context related. On the one hand, a robust analysis of economic, social and environmental impacts is given by using diverse but integrated modelling techniques and qualitative case studies. On the other hand, a wide consultation process is implemented involving stakeholders both in the EU and in partner countries as well as those with a wide international scope of activity, providing opportunities for improved understanding, human capital building, knowledge transfer and dissemination of results. To this extent, the consortium involves, as co-producers of knowledge, several decision-making, research and stakeholder participants with different backgrounds who will use their networks to facilitate the civil society dialogue and build consensus on the subject of gains from trade in view of sustainability.

Project Consortium

No.	Participant Organisation Name	Country
1	Corvinus University of Budapest (CORVINUS)	HU
2	University of Kent (UNIKENT)	UK
3	Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria (CREA)	IT
4	Johann Heinrich von Thünen-Institut, Bundesforschungsinstitut für ländliche Räume, Wald und Fischerei (THUENEN)	DE
5	The University of Sussex (UOS)	UK
6	University of Ghana (UG)	GH
7	Luonnonvarakeskus (LUKE)	FI
8	Centrum Analiz Spoleczno-Ekonomicznych-Fundacja Naukowa (CASE)	PL
9	Food and Agriculture Organization of the United Nations (FAO)	IT
10	Institut national de recherche pour l'agriculture, l'alimentation et l'environnement (INRAE)	FR
11	Confederazione Generale Dell'Agricoltura Italiana (CONFAGRICOLTURA)	IT
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List of Abbreviations

Abbreviation	Definition
EU	European Union
GDP	Gross Domestic Product
LBC	License Buying Company
NGO	Non-Governmental Organisation
SDG	Sustainable Development Goal
TPG game	Threshold Public Goods Game
VSS	Voluntary Sustainability Standards
WP	Work Package

1. Summary

Deliverable 4.4 of the Trade4SD project reports on the findings from a pair of lab-in-the-field experiments looking into the sustainability preferences of both farmers and small-scale traders. The experiments were carried out in two countries (Ghana and Vietnam) and focused on the sustainability of the cocoa and coffee value chains respectively.

Cocoa and coffee farmers participated in a threshold public good (TPG) game designed to capture the trade-off farmers face between private profits and public returns to a sustainable investment for their community. The farmers' experiment tested the power information provision has on nudging farmers towards a higher valuation of sustainability. Additional treatments tried to uncover whether the source of this information would bear any weight on their behaviour in the game and the role that peer influence can have on farmer's valuations of sustainability.

Alongside the farmers' experiment, coffee and cocoa traders were tasked to engage with a simple game designed by the UNIKENT team with the goal of simulating their real-life trading decisions. In the game, traders buy and sell standard cocoa/coffee or invest in organic production and sustainable farming inputs, balancing higher costs with better market returns. The game is also subject to productivity shocks in the form of environmental degradation on their farms which tested whether higher perceived risks of degradation would push traders toward sustainable choices.

The results of the experiments showed that farmers have a greater willingness to invest in sustainability when they were more informed about the benefits and the scale of impact their actions may have on their community. Diversifying information sources in the TPG game led to only minor differences in quantitative analysis. However, qualitative insights from experiment implementation indicated that non-governmental sources of information (NGO's and private firms) may be an effective means of delivering messages that advocate for greater adoption of sustainable farming practices. The farmers' experiment also revealed that peer discussions amplify sustainability efforts, leading to stronger collective action. Traders responded to environmental risks of unsustainable practices, with greater environmental degradation pushing them to demand more sustainable farming.

2. Introduction

The primary focus of the work conducted for deliverable 4.4 is to develop an understanding of how behavioural factors, including altruism, framing empowerment, and agency, influence the responses actors take to sustainable trade policy and institutional frameworks, including sustainability certifications. The work was relevant for several SDGs, including SDG 4 of improved quality of education, SDG 6 of sustainable management of water, SDG 11 sustainable cities and communities and SDG 12 responsible consumption and production.

The EU aims to achieve the United Nations's 17 SDGs by 2030. This has substantial implications for EU trade policy such as more rigorous standards being applied to internationally traded goods and embedded into bilateral trade agreements between the EU and third parties (especially on goods produced in developing countries). As such, EU trade policy

needs to be mindful of the social, economic, and environmental impacts that these more rigorous standards may have not only on the EU agents but also on their developing country partners. Currently, it is unclear as to how eager agents operating in developing economy supply chains are to adapt their current production techniques in favour of more sustainable production methods or whether proposed measures go far enough to satisfy local objectives. EU policy makers should ensure that they create effective trade policies that target the true priorities of agents operating in the supply chains. As such, the design of policy instruments could be critical to achieving more sustainable trade opportunities for the EU and their partnering developing countries.

This deliverable reports the design and results from a pair of experiments conducted in Ghana and Vietnam with farmers and traders in the cocoa and coffee value chains. The experiments were carried out in the field with 310 Vietnamese coffee farmers, 348 Ghanaian cocoa farmers, 64 Vietnamese coffee traders, and 24 Ghanaian cocoa traders. Both the experiments employ revealed preference techniques whereby agents are asked to make decisions that mimic their real-world choices in an environment that is similar to their reality but within the confines of a controlled experiment. The experiments involved both male and female participants enabling the investigation of whether there exist gender differences in preferences towards sustainability. Moreover, since these experiments were carried out in two countries – one in Asia and one in Africa – we were able to make comparisons between different contexts and cultures. Insights from these experiments are useful for trade policy going forward for both the EU and developing country partners.

After consultations with project partners operating in these two countries, an understanding was reached regarding the structure of the cocoa/coffee food chains, and the role agents have with respect to sustainable investments in their production/trading decisions. In addition to this, the literature was scanned to identify the key sustainability issues in the cocoa and coffee value chains and the potential causes. These exercises produced valuable insights to inform the design of the two experiments. In this regard, the decision was made to present farmers with a threshold public good (TPG) game whereby the farmers would be given an opportunity to contribute towards the provision of a sustainable public good for their community and traders were presented with a simple trader game giving them opportunities to invest in sustainable inputs for their hypothetical farms that they trade with.

In this deliverable, section 2 describes the motivation for this study and provides a brief background on the sustainability of the cocoa and coffee value chains in Ghana and Vietnam respectively. Section 3**Hiba! A hivatkozási forrás nem található.** shows the rationale behind the experiment design and section 4 details the method employed for the experiments. Section 5 and 6 shows how the design was shaped through piloting and describes the finalised survey. Section 7 contains the details about the experiment implementation and characteristics of the sample. Sections 8 and 9 discuss the results from both experiments and their policy implications. Sections 10 and 11 conclude and detail policy recommendations.

2.1. Context – Sustainability in Cocoa and Coffee

Two developing countries (Ghana and Vietnam) were selected for this study as they share strong trade links to the EU. Vietnam predominately exports coffee and Ghana predominately

exports cocoa which undergo rigorous standards to ensure a sufficient quality for international markets. 65 per cent of the cocoa produced in Ghana is exported to the European Union (European Commission 2019). Vietnam is the largest exporter of Robusta Coffee beans, with 40 percent of the coffee produced in Vietnam being exported to the European Union (OEC 2023).

Ghana's agricultural sector has employed 40% of the total workforce (World Bank Group 2022) which makes up approximately one fifth of Ghana's total GDP. Cocoa production for export or domestic markets depends on traders' decisions on where to distribute goods purchased from local farmers. Small-holder cocoa farmers in Ghana have been known to follow traditional practices on their farms with plots of land often smaller than 2 hectares. To modernise cocoa production, the EU introduced the Sustainable Cocoa Initiative with the hope of encouraging more sustainable cocoa production in Western Africa.

Private firms dominate production in Vietnam's coffee industry with a majority (95%) owned by smallholder farmers translating to around 650,000 households cultivating coffee with on average one hectare of land (Standen and Falak 2022). In certain regions within Vietnam, there are typically a mix of both agricultural producers for coffee destined for domestic consumption and international markets. This is because in a region/province a selection of coffee farmers can provide and sell their products to global markets while others only have access to local markets. Small-scale farming has produced high variation in production methods, farming investments and harvests which has resulted in uncertain output and variation in the quality of coffee between farms. To combat this uncertainty in output and variation in the coffee quality, there have been efforts to encourage more sustainable trade with the EU through the free trade agreement emphasising sustainability between the two trading bodies.

Across both value chains there are several key sustainability issues that have become prevalent over the last decade. In Vietnam, coffee is a very water consuming crop and in the face of rising temperatures making dry seasons dryer, many farmers have resorted to using groundwater reserves to achieve higher yields which threatens the long-term sustainability of the coffee industry and the lives of local communities that rely on these depleting water reserves for drinking water (Nestlé 2020).

In Ghana, to meet international demand, farmers have had to produce greater quantities of cocoa than ever before, but decreasing availability of arable land, reduced soil fertility and aging cocoa trees have resulted in lower annual crop yields for farmers (Bermudez et al. 2022). Ghana is also suffering from a is a lack of qualified labour to operate in the farming process with significant barriers to production for younger farmers (Löwe 2017). These barriers to production include access to land (which is often owned by older, established farmers), access to finance for fertilisers and pesticides as well as access to formal education on agricultural practices (Löwe 2017). Whilst education is free in Ghana to secondary school level, the costs of school supplies and equipment must still be paid by the student's families which has led to fluctuations in the numbers of enrolled students in education (RGS 2024).

Drawing on these insights on the context and sustainability situation in both countries shaped the design of both experiments.

3. Rationale Behind Experiment Design

Field experiments have often been used to test the strength of behavioural theories by exposing agents to different social and economic stimuli and recording their behaviour. Harrison et al., (2004) proposed several types of field experiment one may adopt such as artefactual, framed, and natural. For this deliverable a framed field (also known as a lab-in-the-field) experiment was selected. The appeal of a lab-in-the-field approach is that one is able to expose the farmers and traders to specific stimuli (through the experimental task) and measure their responses directly through their behaviour in a controlled setting. This means that the experiment should be made relevant to the everyday lives of participants 'framing' them in well-known context and tasks.

When conducting field experiments in different countries Gneezy and Imas (2017) stated that one must account for cultural differences when designing the experiment. Hence, the work on this deliverable involved multiple focus groups and piloting sessions in Ghana and Vietnam to ensure contextual relevance of the experiment. Every effort was made to ensure the experiment tasks remained as simple as possible in anticipation of variation in the mathematical and literacy abilities of experimental participants.

Many previous studies use games to gain behavioural insights from a group towards studied topic. Engaging respondents in gameplay is a revealed preferences technique as it informs the researcher about their preferences without directly asking respondents, reducing doubts that responses are exaggerated or untruthful. In this deliverable, we draw on the 'contextualisation through role playing' argument put forward by Thomas et al., (2019), whereby participants are immersed in a hypothetical, yet realistic, setting that resembles their real decision-making context and environment.

Agent tasks do not always require real consequences, but in some cases, real financial incentives can more accurately measure true preferences, especially among lower-income participants like farmers (Mangham et al. 2009; Meemken et al. 2017). To reflect this, the farmers' experiment used real financial incentives, while the traders' game relied on hypothetical decision-making, provided traders received an adequate participation fee.

To establish a clear cause and effect link in our experiments, it is crucial to understand the assignment mechanism—how participants receive treatment and where measurable outcomes can be expected. For this reason, respondents were randomly sampled in both countries, the respondents were randomly allocated to a treatment type, and participants were unaware whether they were in a treatment or control group.

The literature highlights several different factors to measure when decomposing the decision to invest into sustainability. De Hoop et al. (2010) noted that sustainable investments possess a forward-looking component that agents must account for when foregoing some level of private returns in the present. This led us to include measures for time preferences in both the farmers' and traders' experiment. Another important factor that influences whether an agent is willing to take a chance and invest into sustainability is their risk preferences (Nastis et al. 2019). Investing time and effort into sustainability is only successful when a significant proportion all agents invest as well. Hence, the risk of not experiencing the expected return or benefit will weigh on the agents during the decision-making process (Andersen et al. 2008; Thomas et al. 2019). Furthermore, investments into sustainability may involve an agent's

feeling of a warm glow deriving from altruism (Kits et al. 2014). Hence, across both experiments, care was taken to capture some measures of risk, intertemporal and altruistic preferences.

For this deliverable, two separate games were developed for the farmers and traders to engage with through these experiments. This choice was informed by our research into the context of the studied value chains and findings from Deliverables D4.2 and D4.3, which revealed that these agents (farmers and traders) are exposed to different sustainable investment choices.

In the farmers' experiment, the decision was made to measure strategic behaviour of farmers by varying the information presented to farmers so we can better understand what stimuli will prompt a greater willingness to invest in sustainability. Moreover, both D4.2 and D4.3 proposed that increases in information amongst farmers should improve knowledge on sustainable agricultural practices and increase adoption of VSS. Hence, we test the efficacy of information provision using a threshold public good (TPG) game. A TPG game was selected as the method for the farmer's experiment as sustainable public goods are mainly associated with long term benefits but often have some short-term gain for the individual (de Hoop et al. 2010). In a public goods game, incentives need to be carefully designed so as to avoid crowding out good behaviour and attention must be given to ensure that experimenters allow respondents to indulge their prosocial inclinations if they desire.

The game for the traders' experiment was developed to get an understanding of small-scale trader's motivations towards sustainable investments in their trading decisions. When designing the traders' experiment game, the literature provided some basic guidelines for example, the goals of the game should be clear, players should have the freedom to fail in the game and feedback on their performance should be quick (Simões et al. 2013, Kovács et al. 2017). Tjernström et al. (2021) employed role-playing games to simulate the different returns to farmer's production choices on a virtual farm with maize farmers in Kenya. In our experiment we included inputs that traders were able to select for their virtual farm and introduced uncertainty in the returns to these inputs by attaching probabilities to potential outcomes. Based on Thomas et al. (2019) who used framing to convey the severity of the environmental degradation, the decision was made to present a variable environmental degradation rate to traders to see if this impacts their decisions in the game. One of the policy recommendations in D4.2 was to incentivise better trading practices that minimize environmental impacts. Incorporating the degradation rate into the trader game allows for testing this incentive.

4. Methodology

This section outlines the methods employed in both the farmers' and traders' experiments for the 4.4 deliverable.

4.1. Farmers' Experiment

In light of the relatively low take up in voluntary sustainability standards (VSS) that have been applied on cocoa and coffee production in Ghana and Vietnam respectively, the goal of the farmers' experiment was to understand the behavioural motivations for VSS adoption and to test how different interventions impact their willingness to invest in sustainability. Low VSS

take-up has been attributed to a lack of information regarding the benefits of adoption (Panhuysen and de Vries 2023). Thus, we decided to test the power of being more informed on the willingness to make sustainable investments.

Furthermore, the literature also highlighted that adoption of new technological innovations in developing countries can be magnified when peers interact with one another over the innovation or observe others adopting it (Tran-Nam and Tiet 2022). Hence, in this deliverable we were motivated to find an experimental technique that facilitated analysis of the trade-offs farmers face and tests the power of an information provision intervention on their willingness to adopt a sustainable practice but also whether there can be a peer effect leading to improved information diffusion.

In this deliverable, we were most interested in the public versus private trade-off at a localised level. We considered many different models that would facilitate the capturing of such trade-offs and selected a social preferences model known as a Threshold Public Good (TPG) game.

In essence, a TPG game begins with a group of subjects being individually allocated identical endowments. The endowment often takes the form of an amount of money that is theirs to keep for their own private use outside of the game should they choose to do so. Players are told that they will be given an opportunity to use their endowments to contribute towards the provision of a public good that will benefit their group if provided. However, there is a pre-set threshold that players must meet/surpass with their total group contributions in order to receive the public good. If the group meets the threshold, then all players can enjoy the benefits of the public good being provided regardless of whether they contributed or not. However, if the group is unsuccessful in meeting the threshold, then their group would not receive the public good and player would be left with their endowment net of the amount they contributed to the public good.

To inform the design of the lab-in-the-field experiment, many deliberations went into understanding the decision-making process farmers face when making sustainable investments. One such deliberation regarded whether the farmers' experiment should use a dynamic or static TPG game. A static one-shot game was chosen to best capture respondents' willingness to invest in sustainability, mirroring real-life conditions where investment decisions by others are not always transparent. Similarly, participants in our game could not observe others' actions or adjust their behaviour in response.

However, as we were interested in whether peer influence could alter farmer's behaviour, the decision was made to repeat the one-shot game for a second round. Farmers were not made aware that the game would be repeated to ensure that their behaviour in the first round was a true reflection of their beliefs. Players were also given a separate endowment in this round and instructed that this second round was simply another opportunity for their group to meet the threshold for public good provision.

In our game the decision was made to not refund players if the group was unsuccessful in meeting the threshold nor would they be in receipt of a rebate if excess contributions were given over the threshold. This choice was meant to reflect the nature of community funded sustainable investments that often only show returns in the long run and, in many cases, only if most agents also adopt the same sustainable practices. This is also evident in sustainable trading decisions. For instance, if a producer in a remote area chooses to adhere to a specific

sustainable standard, such as Fairtrade, they may find that Fairtrade buyers are less inclined to travel long distances for a small quantity of sustainably produced cocoa or coffee. However, if other producers in the region also farm to the same standard, it creates a stronger incentive for traders to make the effort to source produce from these remote areas, as they can anticipate a higher yield in sales.

The TPG game for the farmers' experiment was almost identical in both surveyed countries with the exception of the choice of public good. The sustainable public good was provided to successful villages based on their performance in the TPG game. In Vietnam, one of the key issues in the coffee value chain was unsustainable water use. For this reason, the public good was a lecture from an expert on sustainable water management practices for farmers to learn new water conservation techniques. After consultations with project partners in Ghana one of the key issues being the need for greater investment into the education of farmers and future farmers. Hence the public good on offer in Ghana was sustainable education supplies for farmers and children. Specifically, the provision of a small library of books for the local community with an emphasis on sustainability issues such as recycling, climate change and good farming practices.

4.2. Traders' Experiment

To further our understanding of the behavioural motivations of agents in the cocoa and coffee value chains with respect to adoption of sustainability in their trade decisions, traders played a short trader game. This game presented traders with different scenarios and asked them to make a choice based on what they would do if these scenarios were really happening to them. Their goal in this game was to maximise their own profits. Traders entered the game with a hypothetical endowment of money. They were told that in each round they will buy coffee/cocoa from farms and sell it at the end of each round for a fixed market price. There were two types of farms they could buy from in this game: standard and sustainable. To avoid confusion, the definitions in this game were as simple as possible concerning what these two types of farms can do. Standard farms produce standard coffee/cocoa that sells for a standard price. Whilst sustainable farms produce organic coffee/cocoa that sells for a higher price than standard farms. Every round the trader buys and sells the produce from their farms and can use this money to make investments into their supply chain.

Round 1 did not require the trader to make any choices. It was included to illustrate to the trader how the game worked. The traders all began the game by buying identical quantities of standard produce from two standard farms. The cost of purchasing this produce was a set price per kilogram of standard produce. This cost of purchasing was subtracted from the players initial endowment. At the end of the round the produce was sold to the 'market' for a set standard price. The profits from selling that standard cocoa/coffee were carried into round 2. The rest of the game operated under the same premise except each new round gave the participant an option to invest into a 'sustainable' input or not. If the player chose to invest in the sustainable input, then the farm that they buy from becomes sustainable and sells organic coffee/cocoa in the next round. As explained at the beginning of game, sustainable farms sell organic produce to the trader for a price higher than standard produce, which in turn, the trader will sell to the 'market' for a higher price than standard produce. At the end of the game, the player is shown

their profits after five trading periods in the future. This was to illustrate the long-term returns from their choices and allow sustainable investments time to demonstrate their profitability over time.

For brevity, the choices presented to players in each round are simplified and outlined below.

Round 1 – Buy from 2 standard farms, sell standard produce for standard market price.

Round 2 – Buy from 2 standard farms, sell standard produce for standard market price.

R2 Choice: Invest in sustainability training for your standard farms or not.

Training was costly but if the farmers were trained, they could start producing sustainable organic coffee in the next round. There was, however, no guarantee that the farm would choose to adopt this sustainable information and choose to farm sustainably. Hence, the trader would need to think carefully about whether they wanted to invest in such training.

Round 3.1 – For those who did not invest in the training, they still purchase standard produce from two standard farms. However, since the last growing period the soil on standard farms has degraded and coffee/cocoa yields decreased. The level of degradation was randomly determined by one of three depreciation rates.

R3 Choice: Invest in either standard fertiliser or organic fertiliser (more expensive).

The sustainable organic fertiliser, when purchased for the standard farms would allow the standard farms to produce organic produce in the next period.

Round 3.2 – For those who invested in the training in round 2, only one of their standard farms chose to adopt this knowledge and farm sustainably. Since the last growing period the soil on their one standard farm has degraded and coffee/cocoa yields decreased. The level of degradation was also randomly determined by one of three depreciation rates

R3 Choice: Invest in either standard fertiliser or organic fertiliser (more expensive).

The sustainable organic fertiliser when purchased for the standard farms would allow the standard farm to produce organic produce in the next period. If they choose to purchase standard fertiliser, their sustainable farm will no longer make organic produce.

Round 4 – The feedback round. This final stage of the game fed back their accumulated profits over five future periods from their round 3 choice without discounting. They are told how many sustainable farms and standard farms they buy from. They were told how their final profit at the end of the game related to the highest possible profit available in the game. Whereby, if they invested in training for their standard farms in round 2 and if they invested in organic sustainable fertiliser in round 3, they could have made the maximum possible profit in this game.

In round 3, all standard farms suffer a shock to their yields from soil degradation. This cut in yields randomly varied amongst participants. At the beginning of every game session the player was randomly assigned to a depreciation rate of either 30%, 50% or 70% decline in output for

their standard farms. The aim of including this variation was to see if the scale of depreciation affects the decision to purchase a sustainable input for their farms in the game.

Figure 1 depicts the decision tree for one of the three possible outcomes in the Coffee Trader Game for the players. The payoff from electing both sustainable investments (round 4.21) was highest in every instance regardless of depreciation rate. Round 4.12 was the 'socially optimal' round whereby the player chose to invest in the sustainable options at every opportunity they were given. This round was the most socially optimal because the trader had to forego a portion of their current profits to provide for agents other than themselves in the future. By investing into the farms in their supply chain they improve outcomes for their suppliers and could improve environmental outcomes for third parties by investing in sustainable inputs.

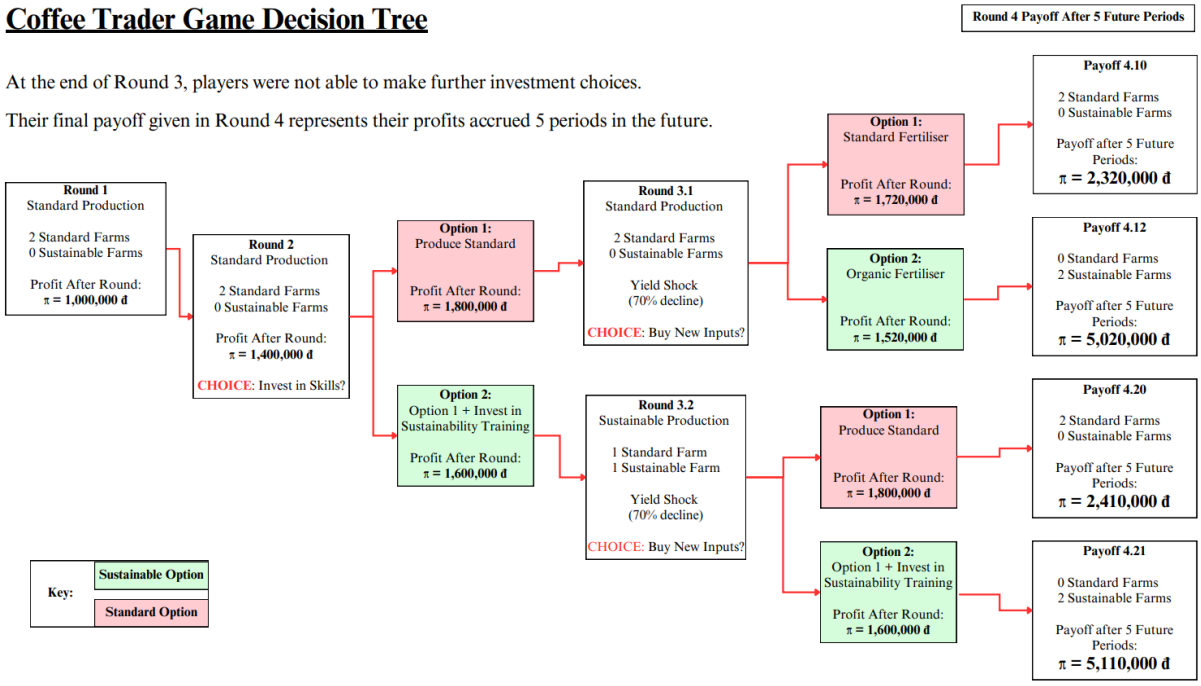

Figure 1 Decision Tree - Trader Game with 70% yield depreciation Source: Own Composition

Conversely, the payoff is the lowest for those who do not make any sustainable investments (round 4.10). Individuals received the second lowest possible payoff when they initially made a sustainable investment and then reverted to a standard production choice (round 4.20). Those who initially did not make the sustainable investment but then switch to investing sustainably in the next round were rewarded with the second highest payoff overall in the game (round 4.12).

5. Piloting

Prior to piloting in Ghana and Vietnam, both the farmers' and traders' questionnaires were tested in the UK with postgraduate students. This exercise was conducted to understand the duration for completing the tasks and to gather opinions on the wording of the questionnaires. From this exercise, several questions were simplified and we had a better idea of the duration for the task. Pilot studies were then conducted in both countries. In Ghana piloting of the farmers and traders used a focus groups method. The information presented to farmers concerned sustainability of the cocoa value chain and their need to embrace new, sustainable

production techniques to preserve the environment, improve their social capital, and increase their productive capacity for the future. Piloting in Vietnam was in the field and allowed us to streamline the survey instrument by removing the questions that appeared to generate confusion amongst participants. The pilot study helped determine which aspect of sustainability to prioritize in the TPG game, ensuring an appropriate threshold was set.

6. Post Game Survey

Additional information was collected from both farmers and traders by survey questionnaires. The information collected in both countries was almost identical. There were questions to gather participants socio-economic characteristics, their farming/trading practices, and measures of their preferences towards different sustainable development goals.

Both the farmer and trader questionnaires were segmented into the following sections:

Section 1 – Hypothetical questions to measure risk preferences, time preferences & altruism.

Section 2 Sustainability opinions with questions to gauge the perceptions of the current and future sustainability of the coffee/cocoa industries.

Section 3 – Socio-economic questions gathering information on their age, gender, race, education level, and income level.

The full questionnaires for both the farmers' and traders' experiment are available on request of the authors.

7. Implementation

This section details how the experiments were implemented in the field, describes the sample and provides insights into the characteristics of the sample.

7.1. Threshold Public Good Game

Real financial incentives[1] were used ensure that participants would make decisions in the TPG game knowing that their actions would have real consequences. During a survey session, groups of between 10 – 20 farmers were collected to participate in one survey session. Each player was given 10 tokens (Figure 2) that represented their total endowment in the game. Token money was exchangeable for real money and that anything not contributed would be theirs to keep on top of their compensation for their participation. Farmers were then read a short script detailing the instructions of the experiment and how to play the game.

[1] The Ghanaian farmers were endowed with 50 cedis (€3.26) per round and the Vietnamese farmers were endowed each with (€3.83). These endowments were representative of their daily wage from farm labour.

Following de Hoop et al. (2010), farmer's contributions in the game were kept anonymous using envelopes. Groups were told to meet a threshold set proportionally to 60% of the total group's total endowment. They were informed that their contributions would be totalled and that they would be told of their success at a later date. During the game play, discussion was strictly prohibited to make sure that individuals would not affect others performance during the first round of the game.

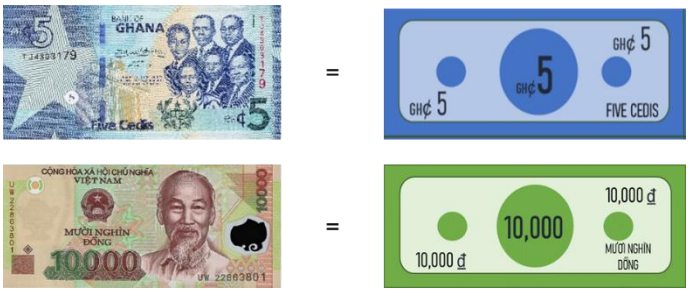

Figure 2 Real and Token Money. Top images 5 Ghanaian Cedis and bottom 10,000 Vietnamese Dong

There were several treatments employed in the farmers' experiment. First, testing the power of information on a farmer's willingness to invest in a sustainable public good for their local community. Second, amongst those individuals who receive information provision, the scripts were subtly altered to specify a different source of the information. Thirdly, the experiment was designed to test whether opportunities for discussion would lead to better social diffusion of information and whether that alters their farmer's willingness to invest in a repeated game. The treatments were allocated at a group level, and the experiment sessions were deliberately organised at a group level to avoid participants being aware that they were in a treatment or control group. As group sessions were at a village level, the implementation design was such that it would minimise communication between villages that may bias the results otherwise. As mentioned previously the allocation between treatments and control was randomised.

Treated farmers were presented with identical information treatment but half were told that the information was from one source and the other half were told that the information was from a different one. In both countries the first source of information was the standard channel – a Governmental source coming from their country's Ministry of Agriculture. However, the second source of information differed by country, due to the contextual differences. In Vietnam the second source of information was from a foreign (EU) non-governmental organisation (NGO). In Ghana, the second source of was specified as a private license buying company (LBC), namely the traders that purchase the cocoa and sell it on the market.

Lastly, to test whether opportunities for discussion with one's peers would alter behaviour of the farmers, we repeated the one-shot game by giving players two separate opportunities to contribute towards the provision of the public good (i.e., they played two rounds with two separate endowments). Both groups that received information treatment and half of the control groups were given 15 minutes between rounds for discussion. During which they discussed their perceptions of their group's performance in the game in meeting the threshold and their valuation of the public good on offer. The pure control group was not given any discussion opportunity. Information about treatments and controls are presented in Table 1.

Groups Received:	Control Groups		Treatment Groups	
	Control A	Control B	Treatment 1	Treatment 2
Basic Information Defining Sustainability & SDGs	✓	✓	✓	✓
Treatment Script with Sustainability Information			✓	✓
Government Source (Ministry of Agriculture)			✓	
Foreign NGO/ LBC Source of Information				✓
Permitted 15 minutes for discussion between TPG game rounds.	✓		✓	✓

Table *1* Treatment and Control Groups in Farmers Experiments Source: Own Composition

Due to the design of the experiment the following analysis thus compared groups performance across and within the groups (comparing treatment groups with one another and individual's round 1 and round 2 performance).

7.2. Trader's Game

Experiment implementation was done by one-to-one interview sessions between experiment enumerators. During these sessions, traders played our trader game (see Figure 3) that was preloaded onto the enumerator's laptop and then answered the post-game survey.

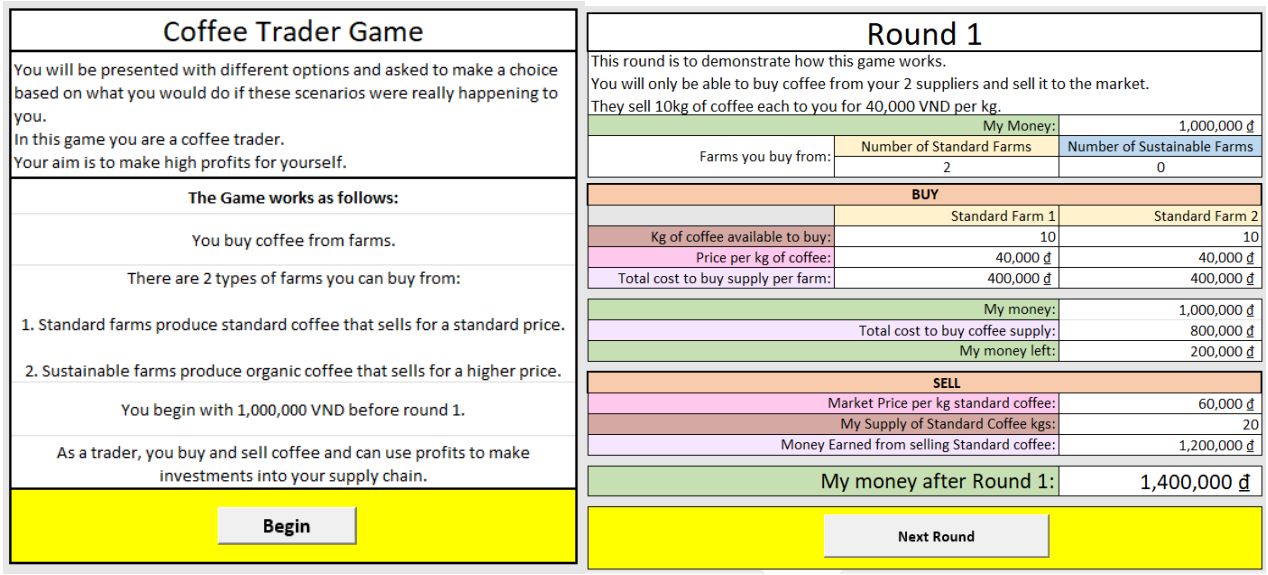

Figure 3 Welcome Screen and First Round Payoffs from Coffee Trader Game Source: Own Composition

7.3. Sample

The experiments were carried out in the Eastern region near Accra in Ghana and the central highlands region (Đắk Lắk and Lam Dong) in Vietnam. These regions both respectively contain a mix of cocoa and coffee plantations densely populated with a substantial number of farmers and traders to act as a population to draw samples from. Data was collected from 310 coffee farmers and 64 coffee traders from October 2023 – January 2024 in Vietnam and 348

Cocoa farmers and 24 traders in February 2024 in Ghana. Smallholder farmers and small-scale traders were the targeted sample. The sampling method was purposive, snowball, and convenience whereby the agents were intentionally selected based on location (top cocoa/coffee producing regions) and whether they primarily produced coffee/cocoa for a living. The networks of Trade4SD partners in these countries were utilised to get in contact with local co-operatives and village leaders.

As mentioned previously, in Vietnam, the respondents came from the two main coffee producing regions: Dak Lak and Lam Dong. Specific regions, districts, or cities with top coffee production these regions were identified. Coffee farmers were surveyed in groups of 10-20 farmers per village and there was a total of 18 villages sampled across these main coffee producing regions. Households were chosen who both farmed to a sustainable coffee certification as well as those without certification.

In Ghana a similar approach was followed. After identifying the main cocoa producing region, (the Eastern region) using the network of partners at the University of Ghana, six top cocoa producing communities in this region were sampled. The cocoa farmers in these communities were randomly allocated to a group of 16 farmers. There were four groups per community and each one was randomly allocated to a different treatment status in the experiment. The traders' experiment was administered identically in both countries. However, implementation was carried out slightly differently in each country for the farmers' experiment.

Of the 86 sampled traders across both countries, 71% were male (63% coffee, 92% cocoa) with a mean age of 46 years old. Sampled coffee farmers were mainly female (57%) and cocoa farmers were mainly male (63%). The ages of the sampled traders ranged from 20 to 72 years old. The age range for the farmers differed greatly by country, Ghanian farmers ranged in age from 20 to 91 (mean 51 years) and Vietnamese farmers ranged from 18 to 78 years old (mean 50 years). Most of the Vietnamese traders (60%) had obtained education level up to university level or above and some were educated up to secondary school (26%). Whilst 50% of the Ghanian cocoa traders had education levels up to junior high school and 29% up to secondary high school. 16% of cocoa farmers reported having no formal education compared to only 2% of coffee farmers. Most coffee farmers (58%) had attended school up to secondary level and the cocoa farmers (51%) reported being educated to a junior high school level.

Vietnamese participants reported higher monthly income than the Ghanaian participants. The median income reported in Vietnam was 6 million VND (€195 in January 2025) which was much higher compared to the median income in Ghana of 1500 GHS (€80 in January 2025). The median monthly income for cocoa farmers was 216 GHS from the previous major cropping season (€53 in January 2025). The income for coffee farmers was higher, with median incomes of 2 million VND (€70 in January 2025). Coffee yields from the last growing season in the Vietnamese farmer survey ranged from 0 to 12,000 kg with a median of 3000 kg. On average cocoa farmers reported more modest yields of 480 kg, with the reported range of cocoa produced lying between 0 – 5120 kg across the farmer sample. The cocoa traders in this sample also operated on a much smaller scale than the coffee traders with the amount of cocoa sold last growing period ranging from 140 kg to 65,000 kg. While the Vietnamese traders reported coffee traded in the last growing period between 8000 kg to 15 million kg.

Most of the sample (80%) traded coffee or cocoa that satisfied at least one sustainable production standard. Farmers in both Ghana and Vietnam farm to a sustainable standard (60%

in Vietnam and 73% in Ghana). Vietnamese traders in this sample mostly sell coffee that adheres to the 4C production standard. Fairtrade was the second most popular standard reported by both the Ghanaian and Vietnamese traders. Around 38% of the Ghanaian traders sold organic cocoa. A higher proportion of Vietnamese traders follow Rainforest Alliance/UTZ standards compared to the Ghanaians, 29% to 4% respectively. Like the traders, the coffee farmers predominantly produced coffee that satisfied the 4C and organic standards, with 19% adhering to Fairtrade. Furthermore, just under half of the sampled cocoa farmers claimed to produce to the organic standard and 26% to Fairtrade.

Respondents were asked various questions about their perceptions of the impact of sustainability standards on different outcomes. Most traders believed sustainability improves produce quality, profits, and supply. While 25% of Vietnamese traders feared standards may reduce coffee availability. 69% of traders reported feeling strong competition for securing supply from farmers although 82% of Vietnamese traders expect a rise in future demand for sustainable products. Among farmers, 55% of cocoa farmers felt no pressure to farm sustainably, while 53% of coffee farmers did. 82% of coffee farmers and 47% of cocoa farmers believed consumers would pay more for sustainable products. However, 83% found sustainable farming time-consuming and 36% felt fatigued from the added work. Whilst most farmers saw gender equality, 25% of female cocoa farmers disagreed. Additionally, 27% of Ghanaian farmers saw child labour as a major issue and 58% disagreed. On environmental concerns, 72% were against deforestation, yet 7% admitted clearing forests for farming.

8. Farmers Experiment Results and Policy Implications

These results present the outcomes on the farmers performance in the TPG game across three different levels of treatment and between countries.

The treatment allocation for the sample in both countries is presented in Table 2.

Treatment Allocation of Farmers in Experiment					
Treatment Group\ Number of Farmers	Total	Treat 1	Treat 2	Control A	Control B
Ghana	348	87	87	87	87
Vietnam	310	93	64	87	66

Table 2 Farmer's Treatment Allocation Source: Own Composition

Treatment was randomly assigned at the group level in Ghana and the village level in Vietnam. In Ghana, four groups of 16 farmers (or 7 in one community) were randomly assigned to treatments, totalling 87 respondents per group. In Vietnam, 51% of farmers were in treatment groups and 49% in control groups, with group sizes by treatment varying due to survey conditions and village-level availability.

The results from farmers performance in the TPG game commences with analysis on the number of tokens given by groups in Table 3 and Table 4. To produce additional insights from these results, further analyses was conducted using Tobit regressions, applying multiple controls for socio-economic characteristics, risk attitudes, intertemporal preferences and

altruistic tendencies. Information on the full econometric approach is available upon request from the authors.

Table 3 displays the total number of tokens donated by cocoa farmers by treatment group across both rounds of the threshold public good game. From this table it is evident that the total contribution for all Ghanaian cocoa farmer groups increased between rounds 1 and 2.

Total Number of Tokens Given by Treatment Status						
Ghana Farmers TPG Game Contributions Between Rounds (Total Number of Tokens)						
	Treated	Control	Treat 1 (Gov)	Treat 2 (LBC)	Control A	Control B
Round 1	759	761	372	387	362	399
Round 2	876	797	429	447	387	410
Round 1 – Round 2	-117	-36	-57	-60	-25	-11
% Change in Contributions	**15%**	**5%**	**15%**	**16%**	**7%**	**3%**
% groups met R1 Threshold	8%	8%	17%	0%	0%	17%
% groups met R2 Threshold	25%	8%	17%	33%	17%	0%

Table 3 Number of Tokens Given by Cocoa Famers in TPG Game (1 token = 5 GHS) Source: Own Composition

Table 3 indicates that the treated groups donated over 15% more compared to the control group when given relevant information and an opportunity to discuss this information before contributing in the second round of the game. To increase the willingness of farmers to invest in sustainability they must be more informed about the importance of such investments and that this information is more impactful on their behaviour when farmers are able to discuss the issue with each other.

Table 4 presents the results from the Vietnamese farmer's experiment. The coffee farmer's performance in the TPG game shows a similar story to the cocoa farmers, whereby the treatment groups outperformed the control groups.

Total Number of Tokens Given by Treatment Status						
Vietnam Famers TPG Game Contributions Between Rounds (Total Number of Tokens)						
	Treated	Control	Treat 1 (Gov)	Treat 2 (NGO)	Control A	Control B
Round 1	873	762	518	355	459	303
Round 2	1002	829	590	412	513	316
R1 - R2	-129	-67	-72	-57	-54	-13
% Change in Contributions	**15%**	**9%**	**14%**	**16%**	**12%**	**4%**
% groups met R1 Threshold	33%	22%	40%	25%	40%	0%
% groups met R2 Threshold	67%	22%	60%	75%	40%	0%

Table 4 Number of Tokens Given by Coffee Famers in TPG Game (1 token = 10,000 VND) Source: Own Composition

The coffee farmers given information donated 6% more than the control group, suggesting that information plays an important role in motivating public good contributions. The governmental source of information groups contributes 2% less than the foreign NGO information group

indicating that a foreign source may be marginally more successful in inspiring higher contributions in public good provision. The discussion opportunity led to a 12% increase in contributions for the group that received no contextualised sustainability information suggesting that peers are influential in farmer's willingness to contribute. The control given no opportunities for discussion only experienced a 4% increase in token contributions between rounds.

Result 1 - The large difference within the treatment group contributions between rounds suggests that information is better diffused in an environment that encourages discussion between peers.

Farmers from the treatment groups were more successful at meeting the threshold than the control groups. The proportion of successful groups increased from one third to two thirds of all information treated surveyed groups between rounds for coffee farmers. Whereas in the control groups there was no change in the proportion of groups successfully meeting the threshold. The proportion of successful groups between treatment types was higher for groups that received information from the NGO source compared to treatment 1 who received information from the Governmental source (75% success rate compared to 60% success rate). None of the pure control groups were successful at meeting the threshold suggesting that information and decision opportunities are impactful in raising the group's willingness to contribute towards the provision of a sustainable public good. Furthermore, the proportion of successful respondents in the half of control groups permitted discussion remained unchanged across game rounds. This indicates that providing farmers with relevant sustainability information significantly influences group coordination in the TPG game.

Result 2 –Farmer's valuations on sustainability are not only shaped by discussions among members but also by the quality and depth of the information informing those discussions.

The effect of the different treatment interventions in the farmers' experiment have been summarised in Table 5. The dependent variable utilised in these Tobit regressions was the number of tokens given in the second round of the TPG game out of their 10 token endowment allocation. The Tobit regressions account for the censored nature of the dependent variable as respondents were only able to contribute between 0 to 10 tokens during the TPG game. The table reports the results from the farmers' contributions by round.

Farmer's Experiment Regression Results				
	Vietnam		Ghana	
Dependent Variable	Round 1 Tokens Contributed	Round 2 Tokens Contributed	Round 1 Tokens Contributed	Round 2 Tokens Contributed
Treatment Group 1	0.869**	1.398**	0.259	0.893**
	(0.386)	(0.477)	(0.336)	(0.366)
Treatment Group 2	0.788+	1.489**	0.158	0.933**
	(0.402)	(0.486)	(0.358)	(0.404)
Control Group A	0.522	1.234**	-0.233	-0.062
	(0.398)	(0.474)	(0.318)	(0.342)
Constant	5.374**	6.118**	4.376**	4.847**
	(0.141)	(0.176)	(0.118)	(0.131)
N	310	310	348	348
Adjusted R squared	0.032	0.040	0.045	0.058

Note: table reports marginal effects from Tobit regressions, robust standard errors in parentheses, significance level denoted: 0.01 **; 0.05 *; 0.1 +

Table 5 Regression Results for Threshold Public Good Game Contributions Source: Own Composition

Table 5 shows that across both countries the groups that received information treatment donated more on average than the control groups. The Vietnamese information treatment farmers were more willing to contribute between 14-15% more than the control groups (this result was significant at the 1% level). This effect was also seen in Ghana, with information treatment groups contributing around 9% more than the control groups (significant at the 1% level). Table 5 confirms the results from the discussions of farmer's performance in Table 3 and Table 4. These results highlight the power that information has on raising the farmers willingness to invest into a sustainable public good for their community.

Furthermore, to test whether farmers are receptive to the source of the information that delivers the sustainability information, we can compare the difference between treatment groups. Table 5 reveals that across both countries the non-governmental source groups performed marginally better than Treatment 1 groups. Whilst the difference is somewhat small in magnitude, drawing on anecdotal evidence from the experimental implementation, it could be debated that less traditional sources of information, like a foreign NGO or a private firm (LBC) could lead to increases in a farmer's willingness to contribute in the game. During the experimental sessions, several participants shared their intrigue over the non-governmental source, commenting that the information had travelled a greater distance to reach them and was potentially more significant. This result was also found in Pabst et al. (2021) whereby a sustainability project received more crowdfunding support when framed to come from a non-governmental source.

Result 3 – Less traditional informational sources, such as a foreign NGO or private firm (LBC), show potential to lead to an increase in farmers willingness to contribute in the TPG game.

This experiment also tested the impact that peer lead discussion can have on farmer's valuation of the sustainable public good. The results in Table 5 show that peer discussion led to a significant rise in the contribution rate, sometimes more than doubling the contributions from the previous round. For the Vietnamese sample, groups given information and discussion opportunities increased their average contribution towards the public good by between 5% and 7%. This was also seen in Ghana, whereby groups given information raised their contributions by between 6% and 8% between rounds. From these results we see that peer influence and discussion opportunities played a role in increasing donations over time, even among respondents who initially contributed less.

The independent variables included in these Tobit regressions revealed that risk attitudes play a key part in the farmers behaviour, with risk lovers being more willing to invest in the TPG game across rounds than risk averse farmers (by 8 -12% in Vietnam and 4-5% in Ghana). Altruism was also a factor in explaining the performance of the respondents, in Ghana more altruistic farmers donated 8% more whilst in Vietnam those who had relatively lower levels of altruism donated 19% less than more altruistic farmers. The age of the farmer was a relevant factor in the Vietnamese sample, revealing that older respondents (over 50 years) were more willing to contribute to the public good than younger respondents by 9 – 13%. The groups that were less willing to contribute in this game across both countries were low-income females (8 – 9% less) than higher income respondents and low-income males. The respondents with higher

education levels donated higher proportions of their endowment towards the provision of the public good (14% more in the Vietnamese sample). In the Ghanaian sample, the respondents that practiced to at least one sustainable standard donated 7% more than those not farming to any production standard. Vietnamese participants with experience in agricultural projects and support for water-conserving coffee production donated 20.5% more in this game than others.

9. Trader Experiment Results and Policy Implications

There were four outcomes in the trader game that a participant could reach. The proportion of traders that reached the socially optimal round (i.e. invested into sustainability twice and reached round 4.21) was 57% overall. With 16% choosing to never invest into sustainability at any point in the game (reaching round 4.10). The proportion of those who strayed from their initial sustainable investment and reverted to their standard production methods were 23% overall (reaching round 4.20). Leaving a modest 3.5% of respondents who initially did not invest sustainably but then decided to when given a second opportunity.

This game offered respondents two opportunities to invest in sustainability (round 2 and 3). However, the framing of this investment opportunity varied between rounds. Round 2 was positively framed and asked whether they would invest in training for their standard farms as it would "*show the farmers how to use water more efficiently and how to grow produce with fewer pesticides*". Round 3 presented the need for investment as a response to a negative shock of soil degradation. The results show that 80% chose to invest in sustainability when the framing was positive (reached rounds 4.20/4.21). 60.5% of respondents chose to invest in sustainability when the framing was negative (in response to a negative environmental shock). It is important to note that this effect was not entirely driven by framing as the investment in round 3 comparatively was double the cost of the investment in round 2. This was to reflect that training (round 2) is often cheaper to provide than production inputs (round 3). Hence, the price of investment also would be a factor in the trader's decision to invest in sustainability. Approximately 23% of traders who initially invested in sustainability later reverted to standard inputs, indicating that investment costs outweighed perceived long-term benefits. In contrast, only 3.5% saw sustainable inputs as a worthwhile investment for standard farms despite the higher cost.

Result 4 - The cost and framing of sustainable investments influence traders' willingness to invest, with lower costs and positive framing making investments more appealing.

Figure 4 shows the results of the trader experiment game broken down by the different environmental degradation rates in the game. 37% of traders were randomly assigned to play the game, with their yields experiencing a depreciation rate of 30%. A quarter of traders were randomly assigned to 50% depreciation rate and 38% were assigned to a 70% depreciation rate. Figure 4 reveals that at higher depreciation rates (70% and 50%), the proportion of individuals who chose sustainable investments was higher compared to those at 30% depreciation rate. This result suggests that agents are willing to invest into training and new sustainable farming inputs if the threat of environmental degradation is higher. At lower levels of environmental degradation in the game, we see more agents choose to not make a sustainable investment. By

showing a higher impact on soil productivity in the game, the traders appear to be more willing to take action to alter their current practices in the hope that this reduces further degradation. This result suggests the need of applied studies about e.g. the impact of unsustainable production practices, e.g. soil productivity, presented to agents in the supply chain either by extension services, research networks or NGOs

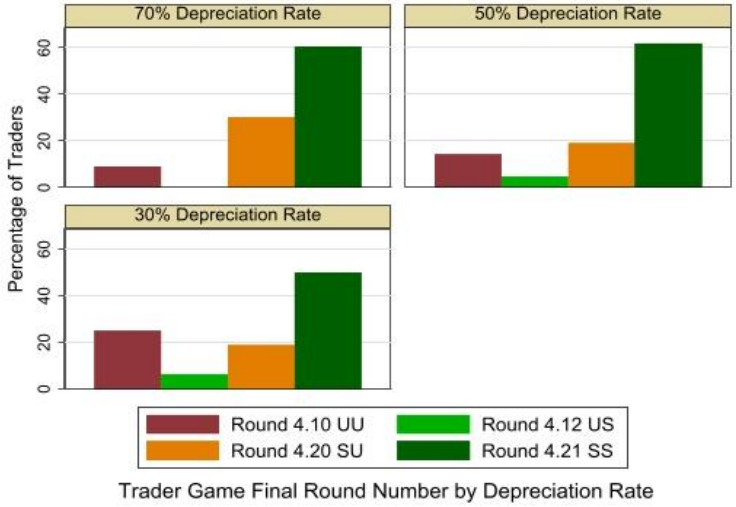

Figure 4 Final round number of traders by depreciation rate Source: Own Calculation

U = Unsustainable Decision
S = Sustainable Decision

Result 5 - The scale and visibility of unsustainable production impacts influence traders' willingness to invest in sustainability. Traders are more likely to adopt sustainable practices when environmental degradation is severe, and the consequences of inaction are more apparent.

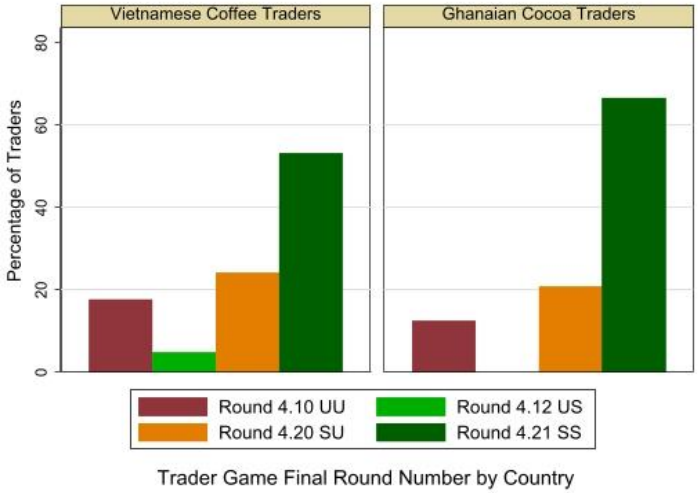

Figure 5 Final round number of traders by Country Source: Own Calculation

U = Unsustainable Decision
S = Sustainable Decision

Figure 5 illustrates the differences between the traders' performances in the game by country. As there were considerably more coffee traders in this sample than cocoa traders, the analysis and graphs produced are presented in percentages to facilitate cross country comparisons.

Both countries follow a similar trend, with most traders reaching the socially optimal round 4.21. Although, the figure shows that a higher proportion of cocoa traders used both opportunities in the game to sustainably invest (reach round 4.21) than the coffee traders in Vietnam (67% versus 53% respectively). This translates to a 14% difference between the countries. The purchasing clerks in Ghana were more localised to a particular cocoa producing village than the coffee traders in Vietnam. Hence, they may take a more vested interest in the way their farmers produce cocoa and therefore make different choices to the coffee farmers in the game.

The trader's survey asked whether the trader had previously ever purchased production input materials for their farmers that supply them with coffee/cocoa. Across the entire sample 73% claimed to have previously purchased input materials such as fertilisers and pesticides for farmers they buy from. These traders were more likely to invest into sustainable inputs for their farms in the game. Policies should facilitate and encourage traders to purchase sustainable inputs for their supplying farmers so that they have a more vested interest in the way that the produce is farmed.

Result 6 - A trader's proximity to, or affinity with, farming communities can influence their attitude toward sustainable investments. Those who are closer to their supply chains are more willing to invest in sustainability.

The post-game survey included hypothetical questions that gave us indicators and measures of the trader's relative risk aversion, time preferences, and altruistic tendencies compared to the other traders within the sample. These more risk averse traders were less likely to engage in decisions that lead to uncertainty. The more patient individuals are willing to save for the future. The more altruistic traders were willing to support another person if they required their assistance. Using these measures, we can see how these characteristics of the individual impacted their performance in the trader game.

Risk averse individuals were much more willing to invest in sustainable inputs and training for their farmers than those who were not risk averse. The traders who appeared to be relatively more patient had a higher proportion that reached the socially optimal round. This effect was not as large as in the case of the risk averse agents but still suggests that agents that are more forward looking may be more considerate of the benefits of sustainable investments and align their choices to maximise outcomes for not only themselves but also for others in the supply chain. In a similar trend to the risk averse individuals, approximately 11% extra traders reached the socially round in the game if they were relatively more altruistic than the other players. This result suggests that those who care more about others are more willing to trade off their private profits for investments into training for their other agents in the supply chain and providing more sustainable production inputs. Overall, when accounting for relative risk preferences, time preferences, and level of altruism, it was found that agents who are more risk averse, patient and more altruistic were more inclined to reach the more socially optimal round of the game.

Result 7 – Traders' willingness to invest in supply chain sustainability depends on their perceived investment risk, expected return timeline, and level of altruism toward improving sustainability for others.

10. Discussion

The lab-in-the-field experiments carried out for the Trade4SD Task 4.4 produced behavioural insights on how to introduce or strengthen some drivers to increase small-scale farmers and trader's willingness to invest in sustainability.

Farmers:

Groups that were successful in meeting the threshold in the TPG game were given sustainability information. This result suggests that information provision can positively alter an agent's willingness to invest in sustainability. Information provision schemes /campaigns tailored to major producing communities and localised depending on the context can have a positive impact as the research for T4.4 gave evidence farmers appear to be receptive to these new ideas and appear to care about the impact their actions have on a wider scale.

Through discussion opportunities between the rounds of the games, farmers appeared on average to positively influence their peers into raising their contributions in the TPG game. This finding supports the need for agricultural extension services to organise discussion forums for both raising awareness of sustainability standards and also increasing the likelihood that sustainability practices become more widely adopted amongst cocoa and coffee producers.

When varying the source of information, the impact of difference between sources was somewhat small in magnitude. However, drawing on anecdotal evidence during experimental implementation, it could be argued that less traditional informational sources, such as a foreign NGO or the private firm (LBC), can lead to an increase in farmers willingness to contribute to sustainability. This result motivates future exploration into the information dissemination channels through which farmers receive information regarding sustainability.

Furthermore, farmers who had indicated previous experience in an agriculturally based community project had also shown higher willingness to invest in sustainability suggesting that previous community experience can increase farmers willingness to contribute to public good for their community.

Traders:

Perceptions of the magnitude of environmental degradation impacted their decision to buy sustainable inputs for their farmers in the game. The threat of environmental degradation manifested in the game as a reduction in the yields from their farms and reduced profits from trade. By showing a higher rate of resource depletion, more traders were willing to take action and choose more sustainable alternative production inputs. If additional information provision schemes were to be implemented to agents in the supply chains, it might be useful to tailor the tone of the message to highlight the more detrimental side from non-adoption and how they can be agents for positive change by altering their current production techniques.

Comparing the two countries, it was observed that the Ghanaian cocoa traders showed a higher propensity to invest into sustainability than the Vietnamese respondents. One reason for this difference is appears to be the fact that cocoa traders in Ghana lived within the same community as cocoa farmers. Their greater willingness to invest in sustainability suggests that a trader's proximity to farming communities may influence their attitude toward sustainable investments in the supply chain.

Traders who had previously purchased farming inputs for their farms also showed a higher willingness to invest in sustainability than those who had not. This suggests that traders already investing in their supply chains may be more effective in driving change and promoting sustainability. As a result, they are likely more motivated to encourage sustainable input purchases among their supplying farmers, fostering a stronger commitment to sustainable practices.

11. Concluding Remarks and Policy Recommendations

Deliverable 4.4 reports on the findings from a pair of lab-in-the-field experiments looking into the sustainability preferences of both farmers and small-scale traders. The experiments were carried out in two countries Ghana and Vietnam and focused on the sustainability of the cocoa and coffee value chains respectively.

The sustainable TPG game employed in the farmer's experiment measured the public-private trade-off involved with certain sustainable investments. The TPG game used real monetary incentives and allowed farmers to make choices that mimic their real farming decisions but in a controlled environment. Increases in contributions in the sustainable TPG game were considered an indicator of greater willingness to invest in a sustainable public good. The public goods on offer involved tackling SDG 4 (quality education), SDG 6 (sustainable water use), and SDG 15 (sustainable land management). Hence, decisions in the game to pledge real finances to fund the public good demonstrated the farmers willingness to trade of their own private benefits (keeping their endowment) for public benefits (improved situation for all in their community). This TPG game facilitated the testing of the efficacy of several policy interventions, more specifically whether information provision schemes are an effective tool for altering a farmer's willingness to adopt new production techniques and technologies such as voluntary sustainability standards. The farmer's experiment repeated the one-shot TPG game once more to test the importance of discussion forums in getting farmers to truly embrace these sustainable standards into their production choices. Therefore, any observed increases in their TPG contribution in the game would indicate the important role that a farmer's peers may have in the acceptance of sustainability in the cocoa and coffee value chains. Moreover, the source of information treatment tested which communication channels for sustainability information would be the most effective at increasing the farmers willingness to invest in sustainability.

A sustainable trader game was developed for this deliverable for cocoa and coffee traders. In the game, traders who are profit maximisers, buy and sell cocoa or coffee from standard farms at a fixed price using hypothetical currency. During gameplay, they had two opportunities to

either continue trading standard produce or invest in upskilling of their farms to produce organic crops, which are more expensive to cultivate but fetch higher market prices. Another investment option allowed traders to purchase and deliver more sustainable farming inputs for their farms. Additionally, the game incorporated productivity shocks through environmental degradation, which varied among players. This variation helped assess whether the severity of degradation influenced traders' decision to adopt more sustainable farming practices.

The results from the work on this Task deliverable support the recommendations from Tasks 4.2 and 4.3. The case studies carried out in Task 4.2 and the literature review of Task 4.3 recommended farmer education schemes to improve knowledge transfers on sustainable agricultural practices, and to enhance both food security and environmental sustainability. The farmers' experiment in Task 4.4 showed that farmers' behaviour was influenced by their increased awareness through information provision. Enforcing a policy that enhances information provision and educational opportunities for farmers will contribute to several SDGs, i.e. SDG 4 (Quality Education) by improving access to knowledge, SDG 1 (No Poverty) by increasing farmers' productive potential and incomes, and SDG 2 (Zero Hunger) by promoting more efficient agricultural practices that enhance yields and strengthen food security. Furthermore, Task 4.2 highlighted the need for additional support in the development of sustainable water management systems. In D4.4 we found evidence that coffee farmers wanted to take steps to acquire additional skills to tackle this issue.

Our work highlighted the importance not only of provision of information but also of how policymakers communicate messages within the supply chain. Effective messaging was able to empower farmers and traders, increasing their willingness to adopt VSS and drive change. Empowering smaller agents in the supply chain enhanced information diffusion and promoted the acceptance of sustainable production standards. This result strengthens one of the policy recommendations in Task 4.3 emphasising that participation of small producers in the governance of VSS should be made compulsory.

To summarise, the main results from research carried out for Task 4.4 are as follows:

Result 1 - The large difference within the treatment group contributions between rounds suggests that information is better diffused in an environment that encourages discussion between peers.

Result 2 – Farmer's willingness to embrace sustainability is not only shaped by discussions among peers but also by the quality and depth of the information provided for those discussions.

Result 3 – Less traditional informational sources, such as a foreign NGO or private firm (LBC), show potential to lead to an increase in farmers willingness to invest in sustainability.

Result 4 - The cost and framing of sustainable investments influence traders' willingness to invest, with lower costs and positive framing making investments more appealing.

Result 5 - The scale and visibility of unsustainable production outcomes influence traders' willingness to invest in sustainability. Traders are more likely to adopt sustainable practices when environmental degradation is severe, and the consequences of inaction are more apparent.

Result 6 - A trader's proximity to, or affinity with, farming communities can influence their attitude toward sustainable investments. Those who are closer to their supply chains are more willing to invest in sustainability.

Result 7 – Traders' willingness to invest in supply chain sustainability depends on their perceived investment risk, expected return timeline, and level of altruism toward improving sustainability for others.

Policy recommendations based on the results from this deliverable support greater allocation of resources towards intensifying information provision schemes as this will partly steer farmers to amend their production methods towards more sustainable alternatives. Farmers' peers were found to be able to increase their willingness to adopt sustainable methods. Hence, policymakers must invest in providing regular information exchange workshops in co-operatives and communities to ensure that information diffusion is as efficient as possible. In doing so, they should have greater predictive power in the efficacy of their promotion of sustainable agricultural campaigns and programmes designed to increase development of rural producing communities. Policymakers could also benefit from using information programs for traders. Based on results from this study, it might be useful to tailor the tone of the message to highlight the consequences from non-adoption, how they can be agents for positive change by helping farmers they purchase from alter their current production techniques and how traders themselves might benefit from such investment in sustainability. In order to increase the effectiveness of information, sustainability messages should come from different sources, not only from the official government channel, as farmers may be more receptive to non-governmental voices when deciding whether to invest in sustainable practices. There is an important role for NGOs, national and foreign, as information providers.

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