

RESEARCH ARTICLE

# Lessons from a participatory community cricket breeding project in Vientiane Province, Lao PDR

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# Abstract

Edible insect production is a key tool for sustainable development and global food security, but its social dimensions and the organisation of farming operations remain understudied. Crickets are among the most recognised edible insects for farming and offer appealing development opportunities for Lao PDR - a Southeast Asian country whose cricket farming sector has lagged behind neighbouring Thailand and which continues to experience challenging economic and food security conditions. Concerning these sustainable development and research priorities, this paper presents the case study analysis of a service evaluation of Cricket Lao Farm, which implemented a project on the distributed (off-site) production of crickets among local community members. Data collection took place from September to November 2023 and included a survey with 30 participants complemented by qualitative information from discussion groups, home visits, informal conversations, and project documentation. While small-scale farming operations ended within a year due to widespread cricket mortality of unknown cause, community-based cricket farming was in principle profitable and demonstrated strong development potential and local relevance. Furthermore, most of the community-based farmers were motivated and interested in resuming operations in the future. The analysis of this case offers important lessons for further development of the cricket farming sector in Lao PDR, highlighting the challenges of the Western social enterprise model in a development setting, the need to actively manage participation, and to develop an understanding of local community structures before commencing operations. To ensure future success, projects should include robust monitoring and evaluation plans; regular and bidirectional communication between community members and the central farm; co-development of breeding strategies, response plans, and good animal husbandry practices; and community engagement activities involving local schools.

# Keywords

case study - crickets - edible insects - Lao PDR - sustainable development

#### 1 Introduction

#### Motivation and objective

The production of edible insects offers a pathway to sustainable development and global food security that can integrate well into non-Western livelihood practices, knowledge systems, and culinary traditions - and with a considerably lower environmental footprint than conventional agricultural development strategies (Hamam et al., 2024; Madau et al., 2020; Moruzzo et al., 2021; Roberts, 2019; Siddiqui et al., 2023; van Huis et al., 2013). Despite persistent negative connotations in Western settings and residual risks of pest and pathogen spread (Aidoo et al., 2023; Dagevos, 2021; Fernandez-Cassi et al., 2018), edible insect production has been explicitly recognised by international actors such as the Food and Agriculture Organization of the United Nations and is being explored as a sustainable development opportunity in low-, middle-, and high-income countries around the globe (Halloran et al., 2018; Madau et al., 2020; Siddiqui et al., 2023; Tanga et al., 2021; van Huis et al., 2013).

Cricket farming is a particularly promising way for edible insect production to sustainably increase incomes, livelihoods, and diets in low- and middle-income countries (Halloran et al., 2018; Moruzzo et al., 2021; Zafar et al., 2024). Crickets are common in both human consumption and insect farming (Hanboonsong and Durst, 2014; Roberts, 2019; Siddiqui et al., 2023). Their favourable nutritional and environmental profile holds the potential for overcoming local and global food security challenges, and it creates opportunities for dietary diversification and the development of innovative supplemental and therapeutic foods (Kemsawasd et al., 2022; Siddiqui et al., 2023; Zafar et al., 2024). Crickets are also a suitable alternative source of chitin and chitosan, used in fields such as biomedicine, cosmetics, and agriculture (Zafar et al., 2024). Cricket farming, particularly of the species Acheta domesticus (Halloran et al., 2018; Halloran et al., 2016; Kemsawasd et al., 2022), is accepted as relatively simple and economically viable. Cricket farming is also environmentally friendly compared to commercial (i.e. industrial-level) harvesting of wild insects and relative to conventional livestock production (Aidoo et al., 2023; Zafar et al., 2024). For example, one kg of edible protein from crickets produces between 2.6% and 5.8% of the  $CO_2$  emissions for an equivalent amount of protein from cattle (Kemsawasd et al., 2022).

Consequently, there have routinely been calls for expanding edible insect production for sustainable development (Halloran *et al.*, 2018; Siddiqui *et al.*, 2023), which would benefit Lao PDR in particular. Lao PDR ranks 140th out of 191 countries on the Human Development Index, and 23.1% of its population are experiencing 'multidimensional' poverty - a considerably higher portion than neighbouring Cambodia (16.6%), China (4.2%), Vietnam (1.9%), or Thailand (0.6%) (UNDP, 2022, 2023). Poverty is particularly acute in rural areas where the majority of Lao PDR's sparsely distributed population resides. Rural livelihoods continue to depend on natural resources and the collection of non-timber forest products - including insects - for sale on local markets and subsistence consumption (Van Der Meer Simo et al., 2019). In addition, nutritional stunting affected 32.8% of children under five in 2023, and 24.3% were moderately or severely underweight (Lao Statistics Bureau, 2024). The COVID-19 pandemic and the subsequent period of geopolitical instability further aggravated the situation in Lao PDR, eliminating any progress made in previous years (UNICEF Laos, 2021; World Bank, 2022).

Farming of edible insects can, therefore, usefully complement and support the development, livelihoods, and nutrition strategies in Lao PDR. Such an approach is locally suitable, considering that more than 50 insect types, including crickets, are regularly consumed across the population (Hanboonsong and Durst, 2014; Roberts, 2019). However, cricket production in Lao PDR has remained surprisingly low compared to neighbouring Thailand - which has become the world's largest farmed cricket producer and played a key role in promoting production norms and developing the cricket industry regionally (Durst and Hanboonsong, 2015; Halloran et al., 2016; Krongdang et al., 2023; Zafar et al., 2024). Market data from 2013 indicated, for instance, that Lao PDR operated a mere 27 cricket farms with a total production volume of 19t annually, compared to more than 20,000 cricket farms with a volume of 7,500t in Thailand (Roberts, 2019). In addition, important research gaps persist in the social dimensions of insect production and the organisation of farming operations (Hamam et al., 2024; Madau et al., 2020), the answers to which may help understand the differential experiences of cricket farming in Lao PDR and Thailand.

Speaking to these sustainable development and research priorities, this paper aims to explore the case of a small-scale distributed cricket production operation in Lao PDR to provide implementation knowledge that can help support the expansion of edible insect production in Southeast Asia. The case under study involved an internal service evaluation by Cricket Lao Farm, a social enterprise in northern Lao PDR that launched a project for the distributed (off-site) production of crickets among local community members. The project can be classified as an integrated conservation and development project due to its (a) community-based approach, (b) intended focus on poverty reduction, (c) resourceconserving production techniques, (d) opportunities to reduce insect extraction from the local environment, and (e) active inclusion of women and vulnerable community members.

#### Cricket Lao Farm

Cricket Lao Farm was a social enterprise legally incorporated in 2017 by Pascal Lovera that specialised in breeding Acheta domesticus crickets (a locally abundant edible insect species; see Halloran et al., 2018; Roberts, 2019). While no legal definition of 'social enterprises' existed at the time of its establishment in Lao PDR, Cricket Lao Farm adopted in its statutes French and international definitions of a cause-driven business whose primary reason for existence was to improve social objectives and serve the common good. Operationally, this meant that Cricket Lao Farm (1) Focused action on local development, reintegration, and anti-exclusion initiatives; (2) Retained profits to maintain and develop the company's activities; (3) Enabled employees to receive shares in the company after one year; and (4) Foregrounded respect of the local Lao labour law whilst also equipping all employees with health insurance. The company also aimed at social development by supporting vulnerable people and their livelihoods and empowering local communities as the primary development actors. It further aimed to obtain organic and Fairtrade certifications for its cricket production while promoting environmental sustainability (e.g. circular economy approaches, agroecological practices).

Initial business operations focused on demonstrating the feasibility and profitability of cricket production. After establishing successful production processes, the second company phase, starting in 2018, involved the construction of a permanent farm site in Vientiane Province (located on a one-hour drive from Vientiane Capital city) to initiate commercial production and scale up the production volume to 100 kg per month. Subsequent years saw the implementation of a greener and more efficient production process through a circular economy approach with a zero-waste process, research on cricket feed, and bio-products extraction from shell and meat. Cricket Lao Farm further developed its production management and marketing strategy as it started serving market retailers, stores, bars, and individuals while also producing wholesale 1 kgpacks of frozen crickets (average price of LAK 35,000 per kg or approx. US \$3.00). The annual production volume increased to 4,105 kg and revenue to US \$15,429 in 2019 – against considerably higher market demand – but harvests remained variable between 150 kg and 600 kg (on average six harvest per year).

By 2020, Cricket Lao Farm maintained a concrete cricket-breeding house of 1000 m<sup>2</sup> (with an effective production area of 600 m<sup>2</sup>) and a nursery with a capacity of 50 nursery boxes. It employed a board of three directors, one production manager, one marketing manager, two full-time workers, two part-time workers, and one full-time sales staff. At that time, Cricket Lao Farm launched a project that involved a distributed (offsite) community-based production structure. The central farm would train villagers in cricket breeding, provide breeding boxes and kits for small-scale cricket production at their homes, and offer them a guaranteed market for their harvests. It targeted women primarily and promoted their roles as business managers, thereby reducing the barriers to poor and vulnerable people becoming cricket farmers (Halloran et al., 2018). The service evaluation of this project is the focus of the current paper.

# Challenges of social-enterprise-driven and participatory development

As the small-scale production of edible insects in low- and middle-income countries is often enveloped in the rhetoric of handing production power over to community-based producers and leveraging their local knowledge (Halloran *et al.*, 2018; Roberts, 2019), it links conceptually to social enterprises for sustainable development and the related field of participatory development. This brief review will provide the conceptual background for the subsequent case study analysis (Yin, 2003).

The social enterprise approach has been praised for creating opportunities for grass-roots and market-based development while prioritising social and environmental concerns as well as economic value generation (Kim and Lim, 2017; Konda *et al.*, 2016; Toner *et al.*, 2008) – including in low- and middle-income countries in Asia (Cho *et al.*, 2019; Lyne, 2019; Umfreville and Bonnin, 2021). However, a critical body of literature increasingly cautions against the limitations and pitfalls of social enterprises as vehicles for local sustainable development. A key theme in this regard is the migration of the social enterprise model from Western to non-Western settings (Hackett, 2010; Toner *et al.*, 2008). For exam-

ple, drawing on experiences from Cambodia, Lyne et al. (2018) documented how (a) employees did deliver the services of social enterprises but struggled with embracing their sustainability objectives, how (b) the hierarchical organisation of the enterprises was at odds both with the participatory and inclusive sentiment of their developmental mission and the complex social relationships within the participating communities, and that (c) the practical interest in the social enterprises was dominated by extrinsic motivation – that is, opportunities to generate income and other material livelihood concerns (Lyne et al., 2018). The Western logic of social enterprises can also collide with the realities of lowand middle-income countries that often include pervasive but often hidden power relationships and complex informal economies in participating communities and competing multi-dimensional livelihood challenges all of which can undermine the inclusiveness and effectiveness of the social enterprise model (Hackett, 2010; Toner et al., 2008).

In a similar vein, participatory and grass-roots development approaches have received considerable attention in international development for their aspirations of inclusive and bottom-up engagement with (and the respect for the local knowledge of) target populations, but with a diverse scholarly critique as well (Botes, 2000; Hickey and Mohan, 2004; Mohan and Stokke, 2000; Platteau and Abraham, 2002). This critical literature raises similar issues - for example, intrinsic tensions between process-based participation and empowerment on the one hand and outcome-oriented development objectives on the other (Chinsinga, 2003; Parfitt, 2004); challenges to the romantic idea of 'community' as a complex social system with inequalities, vested interests, hidden power structures, and conflict (Mohan and Stokke, 2000; Platteau and Abraham, 2002; Sesan, 2014); the potentially problematic relationships between external development actors and local communities (Eversole, 2003); or practical issues in community representation and inclusion that follow from these complications (Davis and Garb, 2019; Hickey and Mohan, 2004). It is, therefore, not surprising that participatory development projects often fall short of their high expectations (Bockstael et al., 2016; Eversole, 2003; Michener, 1998; Sesan, 2014). Challenges of participatory development projects have also been highlighted in the context of Lao PDR, where Cole et al. (2019) documented how they reinforced problematic dependencies and inequalities in the participating communities but also imposed development solutions from the outside despite the banner of participation.

None of this is to say that social enterprises or participatory development initiatives are bound to fail. However, their limitations need to be considered as much as their potential in order to design effective (cricket farming) development strategies.

# 2 Material and methods

To understand the project implementation experiences of Cricket Lao Farm, we employed a single-case study research design (Yin, 2003). This research design enabled both exploratory and explanatory investigations of what, how and why questions within a defined 'case' that can focus on specific actors, organisations, or situations and their developments over time - for instance, how events unfolded, why the case outcomes materialised, and what can be learned from this experience (Yin, 2003). To answer such questions, case study research endorses a multi-method approach (Yin, 2003), as had been done in previous case study publications that explored traditional knowledge, relationships between insects and humans, or the role of social enterprises in non-Western contexts (Haenssgen et al., 2020; Harrison and Nurmohamed, 2023; Kazembe et al., 2024; Lyne et al., 2018; Mawere, 2014; Van Der Meer Simo et al., 2019).

Key elements of the case study research design include (a) the consideration of a defined setting or situation and its evolution over time; (b) methodological pluralism; and (c) the separate description of case context, unfolding of events, and case analysis. Case study applications thereby often relate to theoretical arguments or frameworks to interpret the case materials and explore the applicability of theoretical propositions (Yin, 2003). The present study thus relates the case of the Cricket Lao Farm project specifically to debates revolving around the limitations and pitfalls of participatory development involving social enterprises.

The case study site was Thoulakhom District in Vientiane Province in northern Lao PDR. Based on the latest available census data from 2015, the district had a poverty rate of 9.5%, a net primary school enrolment rate of 73.5%, and 92.4% of households had access to improved water sources (Coulombe *et al.*, 2016). The households participating in the off-site farming project originated from three communities located approximately 5 km away from the central farm site. These communities were ethnically homogenous (i.e. Lao Loum ethnic majority group) and mainly engaged in traditional livelihood activities, including rice cultivation and fishing. Their location by a major river and good road connections to Vientiane Capital city enabled effective access to local and regional markets.

Aside from secondary data involving project-related documents and communications (e.g. documentary clips about Cricket Lao Farm), primary data collection and analysis took place from September to November 2023 by an independent consulting agency (IDeA). Similar to previous research on small-scale cricket farming across Southeast Asia (Halloran et al., 2018), the data collection involved a semi-structured questionnaire comprising open-ended and closed questions complemented qualitatively with discussion groups, home visits, and informal conversations. The questionnaire (available in Supplemental Material) was structured into three modules comprising (a) household and respondent characteristics, (b) production experience, and (c) feelings and feedback towards small-scale cricket farming. Modules (b) and (c) used open questions for first-hand responses from the participants. The questionnaire was developed in Lao by a bilingual study team member (MC), who also led a survey supervisor and three locally recruited Lao survey team members for the data collection. The survey data were collected in Lao and translated (meaning-based) into English and French by the multilingual study team. The qualitative data collection was not audio-recorded (to facilitate unfettered interactions between the study team and participants) but involved handwritten multilingual fieldnotes to summarise and triangulate experiences, feelings, and feedback surrounding cricket farming.

All 54 cricket farming families were invited to join the survey. Participants from 30 farming households were available for the formal survey data collection, all of whom provided their verbal consent and took part voluntarily without a participation incentive. The ensuing farmer sample included 13.3% (4/30) who continued cricket farming at the time of the data collection, between 16.7% (5/30) and 53.3% (16/30) respondents from each study community, 53.3% (16/30) female respondents, and an average age of 54.9 years (SD: 11.8). The data analysis synthesised the primary and secondary data sources descriptively for triangulation (sequentially: quantitative analysis followed by qualitative) and to develop a comprehensive representation of the case and its evolution (Yin, 2003). The presentation of results will first contextualise the situation of the cricket farmers before outlining the case evolution and insights about the outcomes and experiences of the project. Elements of participatory development reflected in the project - interpreted from the empirical

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results – will be addressed separately in the Discussion section.

# 3 Results

#### Participant background

The cricket farmers resided in villages near a major river and forest conservation area. As primary sources of cash income, 66.7% (20/30) of the participating households relied on selling agricultural products (vegetables, fruits, livestock). The remainders derived their income mainly from small-scale shops, salaried work, casual labour such as truck driving, or remittances from their children. Most households engaged in some form of subsistence fishing, gathering, and traditional agricultural cultivation while also maintaining household gardens as important sources of vegetables and herbs for their daily diets. Most households relied on their own production and the natural environment as their main food sources - only 33.3% (10/30) named markets as the main source of their daily food. At the same time, access to rice, an essential dietary staple, was highly dependent on households maintaining rice paddy fields. Consequently, 80.0% (24/30) were not rice sufficient and depended on market purchases to meet their rice demands.

Overall, the living conditions among the cricket farmers reflected a saturation of agricultural lands, the growing population in the case study district, and a gradual transition towards more market-based access to staple foods alongside persistent traditional agricultural livelihoods and the lack of stable paid jobs locally. These conditions created discrepancies between families with and without paddy fields as the main marker of household wealth. Monetary income from cricket farming offered a plausible and pro-poor route to diversifying incomes and counteracting the economic challenges faced by landless families.

#### Case study development

The timeline of the case study evolution over its twoyear period is presented in Figure I. The implementation of Cricket Lao Farm's distributed farming project began in October 2021. This distributed farming activity was initiated as a new project expanding the existing central farming activities (which had become operational in 2018 with the construction of the physical farm site in Vientiane Province) in collaboration with external stakeholders, including Mounoy Development (a Lao start-up enterprise involved in temperature and humid-

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FIGURE 1 Key stages of the case study development.

ity sensors), the Faculty of Pharmacy of the University of Health Sciences in Vientiane Capital (involved in extraction of natural compounds from the crickets), and Institut de Recherche pour le Développement Durable (IRD Laos, involved in scientific support and project management with external funding from Fondazione per l'Aiuto Umanitario with contract ref. 400619/00 under the heading "Research On CricKETs" [ROCKET]). The Planning and Investment Management Office of the local district administration, Head of the Department of Livestock Management, representatives of the District Governor, and village authorities expressed their formal support for the project and its potential to diversify economic livelihoods during and after the COVID-19 pandemic. Project planning at this stage involved the specification of breeding kit provisions and training as well as the refinement of the target participants - aiming especially at poor women and female heads of households, older people and those with disabilities, and generally villagers with an interest in and suitable space for cricket breeding.

Following community outreach, the project proceeded in February 2022 with community-based information sessions which covered selection criteria, training opportunities, the distribution of the means of production, technical follow-up, and marketing modalities. 88 women and 16 men attended the information sessions, of whom 69 registered as volunteers, and 54 families were subsequently selected. The case study data suggested that the families volunteered primarily on economic grounds as they '*wanted to have another income*' (female participant, 37 years old) – and indeed sometimes '*a lot*' of income (female participant, 44 years old) – but several families also expressed curiosity in engaging in and learning a new activity ('*Because* [I have] *no other job to do, want to try*;' male participant, 54 years old) as well as wanting to eat the crickets. The decision to volunteer was made by a female household member in 30.0% (9/30) of cases, by a male in 43.3% (13/30) and as a joint household decision in the remaining 26.7% (8/30) of cases.

The subsequent months saw the development and deployment of a cricket-rearing training programme and manual in the Lao language to prepare the farmers for their work (four hours of training in two parts including breeding theory and techniques, contracting, and hands-on breeding box training; see Supplemental Material for the manual in English), as well as the construction of 100+ breeding boxes. Each box (240 ×  $120 \times 60 \text{ cm}$ ) was equipped with 200 egg trays, two small water dispensers, and a capacity for 15 kg of crickets at harvest.

Production started in September 2022, with each farmer initially receiving two breeding boxes, egg bowls, 5 kg of feed, and on-the-job training for carton-making and egg management. The producer families could consume the crickets, with the excess yield bought by Cricket Lao Farm for wholesale and extracting high-value-added products. As the growth duration of crickets is highly dependent on environmental conditions (requiring a stable temperature between 28 and 33 °C and relative humidity between 40 and 60%), the production was supported by experimental low-cost sensors for real-time temperature and humidity monitoring, and a specialised feed mixture was produced by Cricket Lao Farm and supplied to the community-based farmers.

#### Outcomes

In September 2023, around the fifth production cycle, widespread cricket mortality led to the discontinuation of the community-based cricket farming project.



FIGURE 2 Distribution of income from cricket production across survey participants.

Considering the learning curve of small-scale cricket breeding, by the end of the fourth production cycle (i.e. after four two-month cycles), the average harvest yielded 5 kg per box or 10 kg per family, with a wide range of 1 to 8 kg per box. Such production provided an income of LAK 60,000 to LAK 720,000 (approx. US \$3.00 to US \$35.00 at the time of the case study) per family. This was equivalent to 5.2% of a family's household income on average (Figure 2). However, harvests had become increasingly volatile due to an unexpectedly high rate of cricket mortality. Contributing factors appeared to include hot weather conditions, diseases of unknown aetiology, and likely also feeding practices (see next section). Several families stopped working with Cricket Lao Farm as a result of production failure, while the remaining families intensified their production by adding two to four additional breeding boxes. By July 2023, 22 families had started their fifth cycle of production, which declined further to 12 families at the start of the sixth cycle in September 2023. Overall, 60.0% of the families were able to derive a profit from their production during the project (16/30).

According to the participants, the main reason for discontinuing cricket farming was the death of their crickets (46.2%, 12/26). Other explicit reasons were related to project management and logistics, including the absence of eggs and genitors, or access to breeding boxes and feed (26.9%, 7/26), while a lack of suitable space and time, personal health problems and the lack of income were also mentioned in a few instances. The four families in the survey that continued raising crickets in the sixth production cycle tended to be rice insufficient, liked eating crickets, and generated between

4.0% and 67.0% of their household income from (relatively successful) cricket farming. The off-site farming project (i.e. "ROCKET") thus ended in September 2023. While (unrelated) changes in the personal circumstances of the founder led to the dissolution of Cricket Lao Farm shortly after the project end, a small number of former participants changed the cricket species and continued farming independently of the social enterprise.

#### Experiences and feelings around cricket breeding

Despite the widespread cessation of community-based cricket farming, villagers' experiences within and attitudes towards the project were overall favourable. For instance, time commitments were described as inconsequential. A female participant explained in an interview that, '*We take care of them when we have free time. Generally, we spend around 30 minutes both in the morning and in the evening for cleaning and providing them with food'* – which allowed time for other economic activities aside from cricket farming. As a food source, 83.3% (25/30) of the farmers enjoyed eating the crickets due to their taste, fat, and protein content (a few farmers did not produce enough for consumption or were allergic to insects).

Although only four out of the 30 surveyed families continued operations, 96.7% (29/30) of all participants explicitly indicated that they enjoyed cricket farming. Among the primary reasons were not only that crickets were '*easy to raise*' (44.8%, 13/29) but also that families derived pleasure from the experience, indicating it to be '*fun*' (male participant, 52 years old), that they '*get happiness in raising them*' (male participant, 60 years

old), and even that they enjoy '*watching them and listening to their song*' (female participant, 53 years old). These positive experiential aspects of cricket farming were highlighted by 44.8% (13/29) of the respondents.

Reports about the inconveniences of raising crickets were more limited and primarily revolved around the crickets dying prematurely (73.3%, 22/30). Reasons such as the workload and space requirements were rare (20.0%, 6/30). However, broader conversations indicated that the cricket farmers occasionally complained and desired clearer communication, improved project logistics (e.g. provision of feed), and better training and support. In addition, a key theme in the case study material was the uncertainty surrounding the excess mortality of the crickets. Villagers addressed this issue explicitly, for instance by arguing in an interview that, 'Sometimes we are unsure about the exact cause of [the crickets'] death' (female participant). Likewise, 56.7% (17/30) of the participants confirmed that community members talked about the cricket farming activities, whereby the death of the crickets was an explicit topic in 58.8% (10/17) of the cases (the remainder mentioned more general production techniques and challenges in 35.3% or 6/17 of the cases, and project management experiences in one case).

Aside from the aforementioned factors of weather and a suspected disease contributing to cricket mortality, two other factors were suspected among the farmers (and merit further investigation): food and farming techniques. Firstly, delivery delays from the central farm may have affected feeding schedules, and the (relatively expensive) industrial food may have been blended with pesticide-treated industrial durum corn (intended for feeding poultry, pigs, and cows) with a direct impact on cricket health. Secondly, the farmers and central farm staff disagreed about the most effective breeding techniques. Some farmers argued that 'If we raise crickets our way, we can do it, but if we have to follow all the farm rules, it doesn't work,' preferring natural diets made from plants. In contrast, farm staff repeatedly noted farmers' divergence from trained feeding protocols, such as neglecting regular changing of water and feed.

Where they saw scope to tackle the unexpected cricket mortality, farmers also experimented with alternative production setups. A female interviewee explained her approach: '*During the winter, most crickets are vulnerable and die easily* [...] *However, now I have moved them indoors to raise them*,' and confirmed that this improved the survival of the crickets. In addition, even after stopping their operations, 63.3% of the participants would still be willing to resume cricket breed-

ing, especially if treatment options or alternative and more resistant species could render the production more resilient – or, in the words of one cricket farmer during an interview: '*We would like to continue breeding*, *but only if we change species*.'

#### 4 Discussion

This case study analysis explored a distributed community-based cricket production project in Lao PDR, but widespread cricket mortality resulted in more than three-quarters of the farmers stopping operations within one year. Despite the cessation of cricket production, community-based cricket farming was profitable in principle (fetching similar market prices as reported in Durst and Hanboonsong, 2015; Halloran et al., 2018), it had high development potential and relevance that was endorsed by local authorities, and community members were motivated intrinsically as well as extrinsically to engage in small-scale cricket farming while also consuming part of their production - all of which mirrored experiences from other cricket farming projects in Lao PDR, such as the Insects for Nutrition project by Veterinarians without Borders/Véterinaires sans frontières (2014-2016) and the European-Union-funded project Accelerating Healthy Agriculture And Nutrition (2018-2022) (Weigel, 2016; World Vision International, 2020). In addition, market demand appeared high and was not a barrier to production as previously indicated in Halloran et al. (2018). Most farmers were interested in resuming operations in the future. What explains this discrepancy between the potential and observed outcomes of the project?

While reports from other cricket farming projects in Lao PDR echo some of the production challenges identified in this study (e.g. highly variable production volumes and occasional deaths of crickets from situational and environmental causes such as exhaust gases or cold weather), they offer relatively little information on management dynamics. In contrast, scholars have highlighted the challenges of implementing the social enterprise business model with its inherent Western assumptions into a non-Western developing country context, which could lead to challenging interactions with community members' multi-dimensional livelihood struggles and locally prevailing informal business activities (Hackett, 2010; Lyne et al., 2018). In the case of Cricket Lao Farm, villagers' income from the farming activities typically only complemented (rather than fully accounted for) their economic activities, and

they also appeared to derive non-financial value from the positive experience of cricket farming. However, pressures from the difficult local and broader macroeconomic conditions have plausibly contributed to villagers (and likely also central farm staff) focusing on the financial rather than the social and environmental aspects of the cricket farming project. These competing pressures would suggest that Cricket Lao Farm was not universally interpreted as a social enterprise by its participants and staff (Lyne et al., 2018), which could help explain reports about the informal sale of cricket feed or its blending with cheaper but pesticide-treated corn (Hackett, 2010), and the surprisingly limited sharing of training lessons beyond the original participants (e.g. within their families). On the other hand, a common issue raised in the social enterprise literature is the lack of legal recognition of social enterprises (Cho et al., 2019; Umfreville and Bonnin, 2021), but this did not appear to have affected the project.

The project presented a low intensity of community support and a high degree of delegation of responsibility and tasks to local farm staff. While the intentions of delegation and local ownership are laudable, they rendered the project vulnerable to interactions with power relationships – both within the community but also between local farm staff and the community breeders (Bockstael et al., 2016; Eversole, 2003; Mohan and Stokke, 2000; Platteau and Abraham, 2002; Toner et al., 2008). The practical consequences of these interactions were that farmers were interested but relatively little engaged in the project, the farmers often felt at a loss for information and support, and the central farm struggled with detecting and responding to issues with project logistics and cricket health. The literature had discussed at length such risks of passive participation (Davis and Garb, 2019; Platteau and Abraham, 2002), which highlights that the outcomes of the project are thereby as much the result of relationships as they are of individual choices (e.g. farmers' production conditions) (Eversole, 2003).

Typical recommendations in the participatory development literature to overcome this challenge include the more active, supportive, and intensive management of participation and implementation processes throughout the project to develop mutually trusting and transparent collaborative relationships (Bockstael *et al.*, 2016; Botes, 2000). This process can be supported by more extensive preliminary work to understand local community dynamics and to ensure a more targeted representation of priority groups (Davis and Garb, 2019). Involving additional local civil society actors for

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oversight and relationship management can also potentially support project implementation (Platteau and Abraham, 2002). At the same time, the degree of delegation and local ownership in this project also meant that Cricket Lao Farm avoided reactivating past concerns of participatory development initiatives with too prescriptive actions or a lack of grounding in local realities (Cole *et al.*, 2019).

Future research can further help overcome the limitations of the single-case study presented in this paper to provide a broader knowledge base on the social dimensions and production organisation in edible insect farming within and outside Lao PDR (Hamam et al., 2024; Madau et al., 2020). Especially ethnographic research designs can contribute to uncovering the nature and role of community dynamics, local power, and economic issues to inform more effective participatory strategies for social enterprises (Haenssgen, 2020). Further evaluation research could also explore different community-engagement-based implementation models in non-Western contexts, for instance involving activities and projects at local schools to expose students to cricket farming knowledge and techniques as well to the sentiment of the social enterprise concept. Evaluations of such engagement formats could also assess wider-ranging societal impacts such as sparking interest among younger generations in agroecological, circular, and zero-waste production practices to support the future trajectory of sustainable development in developing country contexts such as rural Lao PDR.

#### 5 Conclusions

This case study underlined the strong market and sustainable development potential of cricket farming in Lao PDR: distributed farming operations under Cricket Lao Farm were, in principle, profitable, received a strong positive market response, and involved enthusiastic farmers and stakeholders. In contrast to concerns in the literature, the labour-intensive nature of insect farming was no concern among the cricket farmers (Siddiqui *et al.*, 2023) – and was instead one of the developmental motivations of the distributed production setup. Similar to reports from Thailand (Halloran *et al.*, 2016), the moderate time requirements can make cricket farming in Lao PDR a beneficial complementary development activity to diversify economic livelihoods.

However, the lack of project success due to widespread cricket mortality and the cessation of community-based farming offered important lessons for the further development of the sector – especially where social enterprise models with a participatory approach are involved. This case highlighted challenges in operating a Western business model in a non-Western development setting, the need to actively manage participation and to maintain a close monitoring routine, and the need to gain a detailed understanding of local community structures before commencing operations.

Immediate practical implications for future smallscale cricket farming operations in Lao PDR and related contexts firstly include a clear monitoring and evaluation plan to track progress and engage early on in remedial action, which requires more intensive staff training and oversight as a prerequisite. Secondly, uncertainty was a major driver underlying the cessation of farming operations when villagers observed cricket deaths. The cricket farmers would benefit from regular and bidirectional communication with the central farm, which would also build trust and support the early detection and investigation of declines in cricket health. Thirdly, the central farm should co-develop breeding strategies, response plans, and good animal husbandry practices together with the community-based farmers, providing a safe discussion space and resources for joint experimentation of different techniques. However, implementers will have to balance technical support and monitoring with opportunities to invite farmer experimentation, traditional knowledge, and adaptation of production regimes that could potentially be superior to the knowledge and experience of the central support organization.

#### Supplementary material

Supplementary material is available online at: https://doi.org/10.6084/m9.figshare.27248349

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#### Author contributions

Conceptualization, ED, PL, MC, SP, SL, MJH; methodology, MC, MJH; validation, ED; formal analysis, MC, MJH; investigation, MC; resources, PL, ED, SL, SP; data curation, MC, MJH; writing – original draft preparation, MJH; writing – review & editing, ED, SP, MC SL, PL, MJH; visualization, MJH, MC; supervision, ED, SL; project administration, ED; funding acquisition, SL, ED, PL.

#### **Conflict of interest**

The authors have no conflict of interest to declare.

#### Data availability

The data presented in this study are available on request from the corresponding author.

#### Ethics

This work was exempt from ethical review requirements due to its nature as an internal service evaluation of Cricket Lao Farm and its employees. Written permission was obtained from the company CEO Pascal Lovera, written authorisation was obtained from district and community authorities, and informed consent was obtained from all participants who were involved in the service evaluation.

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