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From Waste to Wealth: Designing a Participatory Business Model Canvas for Community-Based Maggot Farming in East Java

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Abstract
The growing need for organic waste management and sustainable protein sources has made maggot farming a viable commercial agriculture plan in rural Indonesia. The purpose of this study is to create a participatory Business Model Canvas (BMC) especially for the Maggot Jaya Makmur Cooperative in Srengat, East Java, to improve its community impact and operational sustainability using a Research and Development (R&D) strategy based on the Hannafin and Peck model included needs assessment, collaborative iterative validation by way of expert reviews and focus group sessions as well as design workshops. Local knowledge, resource mapping, and behavioral change techniques are combined in the final BMC so that farmers may see and maximize essential business elements. Participatory design not only increases farmers' knowledge of value creation and consumer segmentation but also promotes ownership and scalability of maggot farming techniques. In comparable socio-ecological settings, this framework gives a repeatable model for community-based agricultural business growth.

INTRODUCTION

Rising interest in sustainable, circular agribusiness models has been spurred by the worldwide issue of food loss and organic waste management. Black Soldier Fly (BSF) maggots farming has become a practical solution, offering high-protein feed substitutes and lowering organic trash (Ikhwan et al., 2025). In Indonesia, where rural areas are already struggling with economic hardship and environmental damage, maggot farming offers a dual opportunity for livelihood improvement and environmental restoration.

Many smallholder maggot farming projects struggle to achieve business viability despite their promise due to poor market orientation and limited strategic planning. The Business Model Canvas (BMC), introduced by Osterwalder (2012) and further developed by Bachmann et al. (2025) and Harahap et al. (2024), is a strategic management tool that offers an organized framework to see and maximize the main corporate aspects. Its use in rural agribusiness settings remains underinvestigated, especially when combined with participatory design methods.

Previous research on maggot farming has predominantly focused on technical and ecological dimensions, including larval growth optimization (Kieling et al., 2023), waste bioconversion efficiency (Siddiqui et al., 2024), and nutritional composition (Gautam et al., 2025). While these studies establish the biological viability of BSF cultivation, they offer limited insights into the development of business models for smallholder contexts. Existing BMC applications in agriculture tend to target commercial-scale operations or technology startups (Bachmann et al., 2025), with minimal attention to participatory co-design processes involving rural farmers themselves.

What remains underexplored is how strategic business frameworks like the BMC can be adapted through participatory methods to suit the socio-economic realities of community-based cooperatives. Specifically, no studies have documented the integration of instructional design models (such as Hannafin & Peck) with BMC co-creation in insect farming. This gap is critical both scientifically—as it limits understanding of farmer-centered innovation processes—and practically, as it hinders the scalability and sustainability of maggot farming initiatives in rural Indonesia.

Particularly in developing countries, the need for scalable, community-based agribusiness models that align with the Sustainable Development Goals (SDGs) underscores the urgency of this study. Although corporate and startup environments have embraced devices like the BMC, their use in rural agriculture extension which typically lacks access to formal business education has been constrained and usually top-down (Amit & Zott, 2021; Saur-Amaral, 2022). By working with farmers themselves to create a BMC framework, this research aims to close that divide and ensure relevance, ownership, and adaptability.

Between January and June 2025, members of the Maggot Jaya Makmur Cooperative were studied in Srengat, East Java. The way the study was conducted reveals an original blend of visual prototyping, participatory design, and scenario-based learning—an approach hardly recorded in maggot farming literature. The originality of this research stems from its methodological fusion: using the Hannafin & Peck instructional design model together with BMC co-creation to create a repeatable agribusiness planning resource customized to local circumstances (Nur Azizah et al., 2025; Simamora et al., 2024; Yildiz & Uzunboylu, 2018).

Hence, this research aims to create a participatory Business Model Canvas for community-based maggot farming in East Java so allowing farmers to grow local based agricultural initiatives that are sustainable and scalable.

RESEARCH METHODOLOGY

Using a Research and Development (R&D) methodology adopted from the Hannafin and Peck instructional design model, this study emphasized systematic stages of needs assessment, design, and evaluation (Adam et al., 2023; Kalkan, 2022; Nur Azizah et al., 2025; Simamora et al., 2024; Yildiz & Uzunboylu, 2018). To guarantee that the Business Model Canvas (BMC) generated is not just conceptually accurate but also contextually appropriate and practically relevant, the R&D framework was selected as appropriate for East Java's smallholder maggot farmers.

The Hannafin and Peck model was selected over alternative R&D frameworks such as ADDIE, Borg & Gall, or Design-Based Research for three key reasons. First, it emphasizes front-end needs assessment and iterative refinement—critical for understanding the contextual constraints and aspirations of smallholder farmers (Yildiz & Uzunboylu, 2018). Second, the model is explicitly designed for non-formal and community-based learning environments, making it more suitable than corporate-oriented frameworks for participatory extension contexts (Nur Azizah et al., 2025). Third, Hannafin and Peck's focus on developing practical

artifacts aligns directly with the goal of producing a usable BMC tool rather than merely testing theoretical propositions (Simamora et al., 2024). This alignment between methodological philosophy and research objectives strengthens both the design process and the validity of the final BMC framework.

Research Design

Three phases of iterative conduct made up the study's phases:

1. Needs Analysis and Contextual Investigation

This phase included a thorough investigation of the cooperative's operating issues, goals, and local dynamics. Data were gathered by means of:

• Field observations of waste management systems and maggot farming techniques.
• Semi-structured interviews with 12 cooperative members, 2 extension agents, and 1 local agribusiness facilitator.
• Stakeholder mapping to spot major players affecting the maggot value chain.

Gaps in corporate awareness—weak customer targeting, unclear value propositions, and limited financial planning among others—identified via thematic analysis. This stage laid the ground for the BMC concept.

2. Workshops in Co-creation and Participatory Design

Over six weeks, fifteen cooperative members engaged in three participatory workshops. Exercises included:

• Real-life business issues investigated using scenario-based learning.
• Visual prototyping using fishbone diagrams and editable BMC templates.
• Role-playing activities meant to mimic consumer engagement and revenue generation.

Based on design thinking ideas (Brown, 2024; Walker et al., 2019) and experiential learning theory (Kolb, 2015), the participatory approach guarantees that farmers actively created the BMC components based on their lived experiences.

3. Iterative Refinement and Validation

Osterwalder's nine building blocks inspired the development of a rubric-based assessment for the draft BMC. Validation included:

• Two agribusiness professors and one extension expert's professional evaluation.
• Focus Group Discussion (FGD) to get input from cooperative members.
• Testing via simulation, where participants used the BMC in invented business situations.

Data Analysis Procedure

Qualitative data from interviews, FGD, and workshop observations were analyzed using NVivo 14 following a systematic thematic analysis approach (Allsop et al., 2022). The coding process consisted of three stages:

1. Open coding: Initial codes were generated from raw transcripts, identifying farmers' statements about business challenges, learning experiences, and behavioral changes (n=127 initial codes).

2. Axial coding: Related codes were grouped into broader categories aligned with BMC components and participatory learning outcomes (n=18 categories).

3. Selective coding: Core themes were refined to reflect cognitive engagement, ownership development, and strategic awareness (n=5 final themes).

Triangulation was achieved by cross-referencing three data sources: field observations (researcher notes), semi-structured interviews (verbatim transcripts), and FGD recordings (coded utterances). To ensure reliability, 20% of transcripts were independently coded by two researchers, achieving an inter-coder agreement rate of 87% (Cohen's kappa = 0.82), indicating

substantial agreement (Dhakal, 2022). Discrepancies were resolved through discussion and consensus.

RESULT AND DISCUSSION

The participatory design approach produced a locally modified Business Model Canvas (BMC) for the Maggot Jaya Makmur Cooperative. Combining local knowledge, resource availability, and community dynamics, the final BMC embodies the cooperative's specific operational context. The BMC output is given in Table 1.

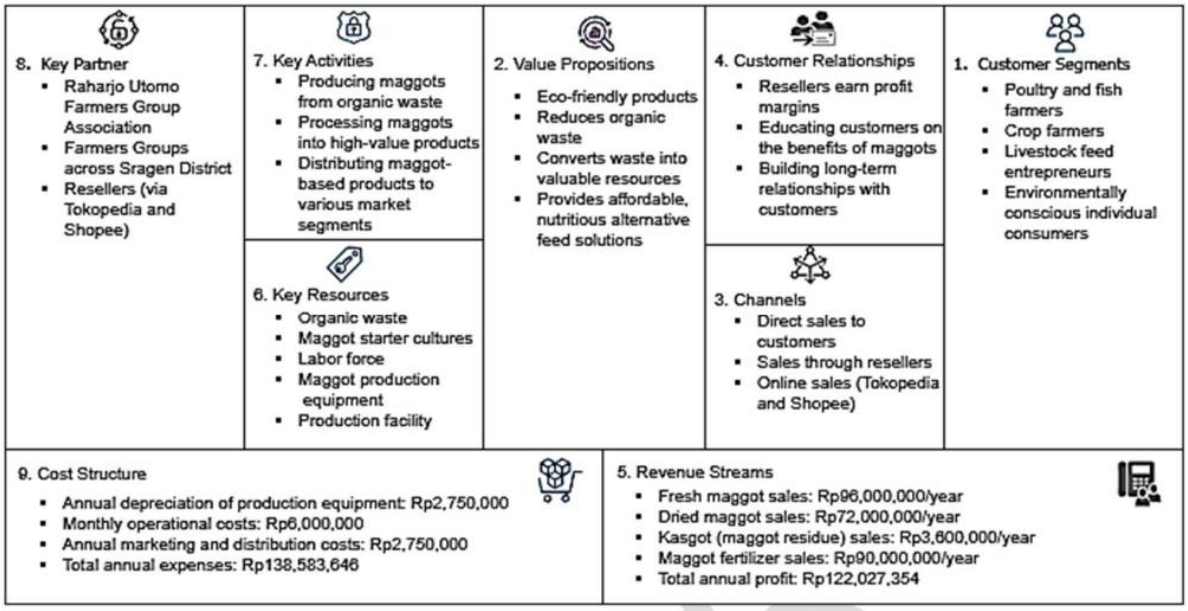
Table 1. Business Model Canvas for Maggot Jaya Makmur Cooperative

Key Partners	Local government, waste contributors, extension agents
Key Activities	Maggot cultivation, waste collection, training workshops
Key Resources	Organic waste, BSF larvae, farmer labor, drying equipment
Value Propositions	Affordable protein feed, eco-friendly waste solution, community empowerment
Customer Relationships	Direct engagement, WhatsApp-based orders, cooperative loyalty
Channels	Local markets, social media, farmer networks
Customer Segments	Poultry farmers, fish breeders, organic farming groups
Cost Structure	Larvae maintenance, packaging, transport, training materials
Revenue Streams	Maggot sales, compost by-products, training fees

Participants in the FGD meetings showed greater clarity in knowledge of their business structure. One cooperative member stated:
"Dulu kami hanya tahu menjual maggot, sekarang kami bisa menentukan siapa pelanggan kami dan bagaimana menjangkau mereka" [Previously, we only knew how to sell maggots; now we can identify our customers and know how to reach them] (Participant F07, FGD Session 2).

Another participant reflected:
"Dengan gambar dan simulasi, saya jadi paham kenapa harga harus sesuai dengan biaya produksi" [With visuals and simulation, I now understand why pricing must align with production costs] (Participant F11, Workshop 3).

The simulation exercise showed changes in behavior in decision-making. Terms previously unknown in their daily business, farmers started talking about consumer segmentation, cost reduction, and product differentiation.



Figur 1. BMC Maggot Business KUB Maggot Jaya Makmur

Discussion

The results show how greatly participatory BMC design increases the cognitive engagement of farmers in company planning. This fits results by Amit & Zott, (2021b), who point out how strategic thinking and entrepreneurial conduct are encouraged by visual business modeling. The systematic BMC acted as both a learning tool and a strategic directional marker in maggot farming, where informal methods prevail. Integrating visual prototyping with scenario-based learning helped to turn theoretical business ideas into concrete actions. This confirms Kolb's experiential learning theory (2015), which maintains that adult learning depends mostly on active engagement and reflection. Farmers started using newly acquired terminology in talks on pricing, customer outreach, and product bundling in addition to picking it up. Furthermore, the co-creation effort fostered among participants a sense of ownership and agency. Unlike top-down extension strategies, this one put farmers as creators of their own company future.

Design thinking enables communities to innovate from within, drawing on their lived experiences as assets, according Brown (2009). Behaviorally, the intervention caused a change from reactive to proactive business attitudes. Farmers started thinking about digital marketing outlets, looking at compost packaging, and preparing for seasonal demand. This change resonates with (Gautam et al., 2025; Huis, 2020; Kieling et al., 2023) calls for farmer led innovation in insect-based agriculture.. The inventiveness of this work stems from its methodological blending of strategic business modeling, participatory extension, and instructional design. This study emphasizes the human and strategic aspects of maggot farming—providing a replicable framework for other rural cooperatives—whereas earlier studies have investigated it from a technical or ecological angle.

CONCLUSIONS AND SUGGESTION

This study shows that participatory design of the Business Model Canvas (BMC) among smallholder maggot farmers can notably improve strategic awareness and entrepreneurial conduct. Incorporating indigenous knowledge, scenario-based learning, and visual prototyping, the final BMC framework helped cooperative members clearly define their

value propositions, customer segments, and operational clearer and more assured solutions. Promoting ownership, better business literacy, and proactive planning, the co-creation process represented a change from unstructured, reactive methods to methodical, scalable agribusiness thinking. Apart from improving the sustainability of maggot farming projects, this method provides a replicable model for other community-based agriculture businesses in comparable socio-ecological environments. Future studies might investigate digital integration of the BMC framework, cross-regional adaptation in Southeast Asia, and longitudinal effects on collaborative development. The results help to shape the wider debate about participatory extension approaches in rural development and inclusive agribusiness innovation.

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