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## Term of Reference

**Applied Research and Field Testing of Biodegradable Coconut-Based Pallets**

Project: CIRCULAR ECONOMY COCOA: “FROM BEAN TO BAR”
Budget line: 6.2.2.2 | Date: July 15, 2025

# CONTEXT

**About the Project**

Helvetas is an independent organization for development based in Switzerland with affiliated organizations in Germany and the United States. Active in Vietnam since 1995, Helvetas has been promoting sustainable agriculture, inclusive economic development, biodiversity conservation, and green innovation, particularly in collaboration with small and medium enterprises (MSMEs).

Within the framework of the European Union-funded SWITCH-Asia Programme, Helvetas is implementing the four-year project *Circular Economy Cocoa: From Bean to Bar* (2022–2026). The project aims to develop circular economy solutions in cocoa and other agri-food sectors, leading to equitable economic growth decoupled from harmful environmental impacts.

**Challenges of coconut waste**

Vietnam, ranked sixth globally in coconut cultivation, spans approximately 188,000 hectares, primarily in the Mekong Delta provinces of Ben Tre, Tra Vinh, and Tien Giang. In 2023, the country produced an impressive 1.9 billion coconuts, as reported by the Asian and Pacific Coconut Community (2023). However, this production generates substantial waste, comprising husk, shell, and coir, collectively accounting for 70% of the fruit’s weight. Consequently, Vietnam is estimated to produce between 1.3 and 1.5 million tons of waste annually, as highlighted by the Vietnam Coconut Association (2023).

Despite this abundant resource, much of the biomass remains underutilized or is discarded or burned, contributing to environmental pollution and carbon emissions. Only a small portion is processed into coir ropes, mats, and growing media for export or local use. Innovative applications that increase the value of coconut waste are increasingly necessary to support the circular economy and reduce pressure on natural resources.

**Coconut-based pallets**

Coconut-based pallets are gaining global attention as a sustainable alternative to wooden and plastic pallets in logistic industry due to their renewable, biodegradable properties and compliance with phytosanitary standards.

Countries such as Switzerland (NatureLoop’s CocoPallets), the Netherlands (CocoPallet, CocoBoard), and the Philippines (Coco Veda) have developed coconut husk pallets to reduce deforestation, eliminate chemical treatments, and comply with international shipping standards. In Vietnam, this application is still at an early stage, with emerging players such as as [NetZero Pallet](https://www.netzeropallet.com/), [Daravin](https://daravin.vn/san-pham-cua-daravin/vat-tu-linh-kien/pallet-xo-dua-2-tang.html), [Vinatap Coco Pallet](https://vinatap.vn/pallet-xo-dua-xuat-khau-la-gi.html), [Hoang Viet Thao Pallet,](https://pallethoangvietthao.com/pallet-xo-dua.html?srsltid=AfmBOoqRYNEEjjjeSFYYzoLMvZo4Bupz6Xzw2oYdY0uV0jhG5q-u3MIW) showcasing significant potential for repurposing agricultural waste to value-added products.

However, broader market adoption faces technical and perceptual barriers. Key limitations include insufficient load-bearing capacity, poor water resistance - especially in prolonged exposure, and susceptibility to mold and pests in suboptimal storage. Variability in raw material quality—such as fiber cleanliness and moisture content—also affects consistency. As a result, user confidence in the durability and reliability of coconut-based pallets remains low.

To address these issues, Helvetas is seeking a qualified consulting team or firm to conduct applied research and field testing to optimize the technical performance and commercial readiness of coconut-based pallets. The findings from this package will be widely shared with interested businesses to facilitate uptake of the initiative and generate addtional income, thereby contributing to livelihoods for coconut smallholders in the Mekong Delta

# OBJECTIVES

* To conduct in-depth applied research to optimize the technical performance of biodegradable coconut-based pallets, with a focus on:

(i) structural integrity (load-bearing capacity, mechanical strength);

(ii) resistance to moisture, microbial and fungal growth;

(iii) operational functionality in logistics (handling, stacking, transport compatibility)

while ensuring environmental sustainability, including biodegradability, use of renewable inputs, and minimal lifecycle environmental footprint.

* To supervise the pilot production and coordinate the field validation of 500 coconut-based pallet prototypes, in collaboration with 8–10 project partner SMEs acting as end-users.

# SCOPE OF WORK

* **Desk research**: Review and assess existing designs and technical performance of current coconut-based pallet prototypes with a focus on their suitability for industrial use in agricultural product supply chains.
* **Lab-testing and optimization**: Conduct laboratory testing and formulation optimization for coconut-based pallets including adjustments to material composition, mixing ratios, pressing conditions, and other process parameters to achieve the above mentioned objectives.
* **Supervision of pilot production:** Collaborate with the designated pallet manufacturer to integrate the improved formula into production processes, and supervise the fabrication of 500 upgraded prototype pallets (using coconut waste from Ben Tre province);
* **Field testing and feedback**: Coordinate field trials in partnership with 8–10 selected SMEs, ensuring pallets are tested under diverse real-world logistics and operational conditions. Collect and analyze both feedbacks from end-users on pallet performance, identifying key technical strengths, weaknesses, and opportunities for further refinement.
* **Reporting**: Document all technical findings, including test results and field survey, and develop clear, actionable recommendations for future product development and potential commercialization strategies; Present the research results to relevant stakeholders via 1–2 knowledge-sharing events or workshops, if required.

# REQUIRED QUALIFICATIONS

The Consultant/Team should meet the following requirements:

* A university degree (Master’s level or above preferred) in materials science, chemical engineering, polymer science, mechanical engineering, or related disciplines.
* Proven experience in developing bio-based materials or biomass composite products, especially in areas such as particleboards, fiberboards, or molded fiber products.
* Solid knowledge of natural fiber-reinforced composites, binding agents, and relevant processing techniques (e.g., hot pressing, extrusion, compression molding).
* Demonstrated capacity to design and conduct laboratory-scale and pilot-scale experiments, including statistical optimization (e.g., Design of Experiments - DoE).
* Familiarity with testing standards and protocols for mechanical properties (e.g., load-bearing strength, durability, water resistance, thermal stability).
* Experience working with agricultural residues (e.g., coconut husk, coir fiber, rice husk) is an advantage.
* Ability to document and communicate technical findings clearly in English and Vietnamese.

# DELIVERABLES

The consulting team/firm is expected to deliver the following:

* 01 technical review report on the existing coconut-based pallet prototypes.
* Laboratory testing results and a proposed optimized formulation for coconut-based pallets.
* Field trial report, including performance testing results and practical feedback from end-users.
* Final report summarizing all research activities and key findings, including feedback analysis, and practical recommendations for formulation, production and commercial viability, identified risks and suggestions for scale-up or further R&D.

# SUGGESTED TIMELINE

| **Activity** | **Tentative Date** |
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| Proposal submission deadline | By July 31, 2025 |
| Selection and contract finalization | By August 5, 2025 |
| Implementation period | August-October (~3 months) |

# TECHNICAL & FINANCIAL PROPOSALS

Interested consulting firms or expert teams are invited to submit:

* Technical Proposal: outlining the approach, methodology, team composition, relevant experience, and timeline.
* Financial Proposal: detailing cost breakdown, consultant rates (daily based), budget justification, and any additional cost considerations.

Proposals should be submitted by **July 31, 2025** to the following email addresses: helvetas.vietnam@helvetas.org and diep.dinh@helvetas.org.

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