

# Valorising Rice Husk and Cattle Manure for Circular Rural Empowerment

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## ABSTRACT

Parangbanoa, Pallangga District, Gowa Regency, South Sulawesi, is an assisted community within the village empowerment programme where cattle farming constitutes an important local livelihood activity. The coexistence of livestock activity and agricultural residues creates an opportunity to convert locally available waste into productive inputs. This community engagement initiative aimed to strengthen local capacity to utilise rice husk-derived material and cattle manure as horticultural growing media while introducing a practical pathway towards circular rural economic diversification. The programme used a participatory mini-workshop comprising leaflet-assisted education, a baseline pre-test, material explanation, demonstration, and hands-on preparation of growing media. Photographic documentation indicates the participation of approximately 30 adult community members, predominantly from livestock-farming and agriculture-related households. Participants were directly involved in the preparation and mixing process, producing a practical prototype pathway for transforming agricultural and livestock residues into horticultural inputs. Because a verified post-test recap, product-adoption record, and income follow-up were unavailable, the programme is interpreted as an early-stage capacity-building intervention rather than evidence of realised income growth. The initiative is consistent with circular economy principles and Islamic economic ethics concerning resource stewardship, avoidance of waste, and public benefit.

**Keywords:** circular economy; cattle manure; community empowerment; growing media; rice husk

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## 1. Introduction

Rural economic development increasingly requires approaches that connect local resource potential with environmental responsibility. In agricultural and livestock communities, materials conventionally treated as waste can become productive inputs when they are recovered, processed, and returned to local production systems. This logic is consistent with the circular economy, which seeks to reduce resource losses and retain material value within economic systems rather than relying on linear patterns of extraction, consumption, and disposal (Geissdoerfer et al., 2017). At community level, circularity is particularly relevant when locally available residues can be processed using techniques that are understandable, affordable, and replicable by residents.

A livestock-oriented assisted rural community provides a relevant setting for this approach. The official programme profile identifies cattle farming, particularly Bali cattle, as an important local livelihood activity. The village empowerment programme encompasses dozens of beneficiary households and incorporates training on the agricultural utilisation of animal manure alongside

institutional strengthening, marketing, and Islamic financial literacy. This programme context indicates that livestock production, community empowerment, and productive use of local resources are already interconnected within the wider village development agenda.

Cattle farming produces organic residues that can create sanitation and environmental problems when unmanaged, yet manure also contains organic matter and nutrients that can support agricultural production after appropriate treatment. At the same time, rice production and milling generate rice husk, a lignocellulosic residue that is often underutilised. Converting rice husk into rice husk charcoal or biochar and combining it with organic amendments can improve the physical and chemical properties of growing media. A broad review by Agegnehu et al. (2017) found that biochar-compost mixtures can improve soil properties and crop performance, although outcomes vary by feedstock, soil, climate, and application conditions.

Recent horticultural studies in Indonesia also show the practical value of combining cattle manure and rice husk charcoal. Wartabone et al. (2026), for example, found that combinations of soil, cattle manure, and rice husk charcoal significantly affected mustard growth and yield, with a treatment consisting of 50% soil, 30% cattle manure, and 20% rice husk charcoal performing favourably. Earlier experimental work has likewise reported that a 1:1:1 mixture of soil, rice husk charcoal, and cattle manure can provide a workable growing-medium formulation for mustard cultivation (Ndiwa et al., 2022). These findings do not establish a universal formula, but they support the technical plausibility of using the two local residue streams as components of horticultural media.

Community-service studies further demonstrate that waste valorisation becomes more meaningful when residents participate directly in the production process. Alam et al. (2023) used counselling, demonstration, and group discussion to help a livestock and farming community produce locally sourced soil-improvement materials from rice husk biochar and cattle manure. Widyananda et al. (2024) similarly reported community training on solid organic fertiliser made from rice husk and cattle manure. More recently, Rosnelly et al. (2026) used a participatory approach to convert rice husk and cattle manure into compost, emphasising both waste reduction and the possibility of lowering dependence on external agricultural inputs. These experiences suggest that participatory practice is central to translating technical knowledge into usable community capability.

The relevance of this approach is not limited to environmental management. From a rural livelihood perspective, locally produced growing media may reduce input dependence, support household horticulture, and create the basis for a small-scale product that can be packaged and marketed if quality and demand are validated. Such possibilities should, however, be distinguished from realised economic impact. Productive potential does not automatically translate into sales or higher income. Demonstrating economic benefit requires follow-up evidence concerning adoption, production continuity, costs, product quality, customer acceptance, and actual transactions.

The programme also has conceptual relevance to Islamic economics because it operates within a Sharia-oriented community-development setting. Contemporary literature increasingly identifies compatibility between circular economy practices and Islamic principles such as stewardship, avoidance of waste, protection of wealth and the environment, and *maslahah* or public benefit (Afandi & Rahma, 2025; Septiani et al., 2026). In this article, these principles are used as an interpretive framework rather than as measured programme variables. The practical intervention

itself remains centred on community skills, local residue utilisation, and horticultural input development.

Against this background, the community engagement activity was designed to introduce residents to the practical transformation of rice husk-derived material and cattle manure into horticultural growing media. The article aims to describe the implementation process, document the immediate outputs and observed participant engagement, and critically assess the intervention as an early-stage pathway towards circular rural economic diversification. Particular attention is given to distinguishing documented achievements from longer-term economic outcomes that remain prospective.

## 2. Method of Implementation

### 2.1. Setting and participants

The activity formed part of the 2026 BSI Scholarship Social Project implemented in Parangbanoa, Pallangga District, Gowa Regency, South Sulawesi. The local context is characterised by the BSI-assisted cattle-farming cluster and by the availability of livestock residues that can potentially be reintegrated into agricultural use. The workshop targeted adult community members connected to livestock-farming and agriculture-related household activities. Based on the available photographic documentation, approximately 30 community participants were present. This number is reported as an approximate participation count because a signed attendance register was not available in the source documentation used for manuscript preparation.

### 2.2. Design and practical procedure

A participatory capacity-building design was used. The intervention combined short-form education with practical demonstration so that participants could move from conceptual understanding to direct material handling. The documented sequence consisted of programme opening, distribution of educational leaflets, administration of a baseline pre-test, explanation of the growing-media concept and preparation process, and hands-on mixing by community participants. The approach was intentionally simple because the intended technology needed to be reproducible with locally accessible resources rather than dependent on specialised equipment.

The practical session focused on converting locally available agricultural and livestock residues into a horticultural growing-medium mixture. The documentary evidence supports the use of rice husk-derived material and cattle manure-based organic material, together with a soil-based fraction during the mixing process. The exact volumetric ratio used during the workshop was not preserved in the available documentation and is therefore not reported as an observed programme parameter. For future replication, published horticultural studies provide several defensible formulations, including soil, rice husk charcoal, and cattle manure at 1:1:1 by volume or alternative balanced proportions depending on the crop and desired physical properties of the medium (Ndiwa et al., 2022; Wartabone et al., 2026).

The practical process emphasised four operational principles: the organic manure component should be sufficiently matured to reduce phytotoxicity risk; the rice husk-derived fraction should improve porosity and aeration; the components should be mixed until visually homogeneous; and moisture should be added gradually rather than saturating the mixture. Because the programme was a community training activity rather than an agronomic experiment, no laboratory analysis

of nutrient content, pH, bulk density, or plant growth response was conducted as part of the documented workshop.

### 2.3. Evaluation approach

A baseline pre-test was distributed before the main explanation and practice. The available documentation confirms the administration of this pre-test but does not contain a complete score recap or verified post-test results. Consequently, the article does not calculate knowledge gains or statistical significance. Immediate programme outcomes were instead assessed descriptively from documentary evidence, including participant attendance, engagement in the practical process, successful completion of the mixing stage, and the presence of educational materials. External literature and official BSI programme information were used to interpret the technical and developmental relevance of the activity, but not to substitute for missing programme measurements.

The implementation stages and immediate outputs are summarised in Table 1.

**Table 1.** Programme stages and immediate outputs

| Stage                       | Main activity                                                                                                     | Immediate output                                                |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Context identification      | Recognition of cattle-farming and agricultural residue potential in the assisted community                        | Local resource-based intervention focus                         |
| Educational preparation     | Leaflet distribution and baseline pre-test                                                                        | Learning materials and initial participant assessment           |
| Mini-workshop               | Explanation of waste valorisation and growing-media preparation                                                   | Shared conceptual understanding of the process                  |
| Hands-on practice           | Participatory mixing of rice husk-derived material, cattle manure-based organic material, and soil-based material | Practical experience and a prototype growing-medium batch       |
| Reflection and continuation | Discussion of horticultural use and possible economic development                                                 | Potential pathway for household use and product diversification |

*Source:* Authors' reconstruction based on programme documentation, 2026.

## 3. Results

### 3.1. Programme implementation and participation

The opening session positioned the workshop as a practical community activity rather than a classroom-only intervention. Participants were introduced to the objective of processing locally available residues into useful growing media. This framing is consistent with circular economy thinking because it shifts attention from waste disposal towards resource retention and repeated local use. It also establishes a direct connection between environmental management and household-scale productive activity.



**Figure 1.** Opening of the mini-workshop and introduction to the community empowerment programme.

*Source:* Programme documentation, 2026.

Educational leaflets and a baseline pre-test were distributed before the core material was delivered. This sequence is methodologically useful because it separates participants' initial exposure from the subsequent explanation. Although the score recap was not available for analysis, the pre-test still served an operational function by signalling that the workshop concerned learning and skill acquisition rather than merely ceremonial participation.

The visual evidence also indicates broad participation by adult men and women, which is relevant in a household-oriented rural economy. A mixed participant profile may support wider diffusion because decisions concerning livestock residues, home gardening, purchasing of agricultural inputs, and small-scale household enterprises are not necessarily confined to one occupational group. Nevertheless, the present documentation does not support subgroup analysis by age, gender, occupation, or prior farming experience.



**Figure 2.** Distribution of educational leaflets and administration of the baseline pre-test to community participants.

*Source:* Programme documentation, 2026.

### 3.2. Technical delivery and hands-on practice

The explanation session introduced the materials and stages required to produce the growing medium, after which participants moved to hands-on preparation. Figure 3 documents the technical explanation delivered before the practical activity.



**Figure 3.** Facilitator explaining the concept and preparation process for horticultural growing media.

*Source:* Programme documentation, 2026.

During the practical session, community members directly participated in mixing the material. The activity therefore moved beyond informational exposure and provided participants with direct procedural experience in handling and combining the locally accessible components. Figure 4 documents the participatory mixing process.



**Figure 4.** Community participants taking part in the practical mixing of growing-media components.

Source: Programme documentation, 2026.

### 3.3. Immediate outputs and evidence status

It is important not to overstate what the workshop demonstrated. The activity documented the preparation process, but it did not test seed germination, vegetative growth, yield, pathogen safety, nutrient content, or storage stability of the resulting medium. Accordingly, the workshop output should be understood as a practical prototype and capacity-building exercise rather than as a validated commercial growing-medium formulation.

The most defensible outcomes are immediate and process-oriented. Participants received educational material, completed a baseline assessment, observed the technical explanation, and took part in preparing the growing-medium mixture. These outputs establish that the programme moved beyond awareness raising into participatory skill practice. They also provide a foundation for future adoption if follow-up mentoring is conducted.

Table 2 consolidates the documented results, the strength of the available evidence, and the interpretation that can be supported from the programme records.

**Table 2.** Documented programme results and evidence status

| Result domain | Documented result                                                   | Evidence status                                                     | Interpretation                           |
|---------------|---------------------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------|
| Participation | Approximately 30 adult community participants attended the workshop | Supported by photographic documentation; exact register unavailable | Community reach, but not an exact census |

| Result domain            | Documented result                                                                               | Evidence status                              | Interpretation                                                |
|--------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------|---------------------------------------------------------------|
| Education                | Leaflets were distributed and a baseline pre-test was administered                              | Directly documented                          | Baseline learning activity; no verified score recap           |
| Knowledge transfer       | Facilitator explained the preparation process and material functions                            | Directly documented                          | Structured technical introduction                             |
| Practical skill exposure | Participants took part in mixing the growing-medium components                                  | Directly documented                          | Immediate procedural learning                                 |
| Product output           | A prototype growing-medium mixture was prepared during the session                              | Supported by the documented practice process | Early-stage product development, not quality certification    |
| Economic outcome         | Potential household use and product diversification were introduced                             | Prospective, not yet measured                | No claim of realised sales or income growth                   |
| Sustainability           | Follow-up standardisation, crop testing, costing, packaging, and market validation are required | Analytical recommendation                    | Necessary for progression towards a circular micro-enterprise |

Source: Programme documentation and analytical interpretation by the authors, 2026.

### 3.4. Implementation constraints

Three limitations constrain the strength of impact claims. First, the available baseline pre-test was not accompanied by a verified post-test recap, so changes in knowledge cannot be quantified. Second, the exact workshop formulation was not preserved as a standard operating procedure, limiting direct replication. Third, there was no follow-up evidence on repeated production, horticultural performance, packaging, sales, or income effects. These limitations mean that the programme provides evidence of implementation and immediate capacity building, but not yet of sustained behavioural or economic impact.

## 4. Discussion

The intervention was strongly aligned with the resource profile of the assisted community. The official village programme profile identifies cattle farming as a recognised local livelihood activity and includes the agricultural utilisation of livestock manure within the broader empowerment agenda. This is important because community training is more likely to be relevant when it begins with materials already present in the local production system. Rather than introducing an externally dependent technology, the programme reframed two locally available residue streams as potential inputs for horticulture.

The transition from explanation to direct practice is a central strength of the programme. Community empowerment interventions dealing with organic amendments are more actionable when participants physically handle materials and observe consistency, moisture, and mixing procedures. Alam et al. (2023) similarly combined counselling and demonstration in a community producing soil-improvement material from rice husk biochar and cattle manure, while Rosnelly et al. (2026) emphasised participatory practice as a mechanism for strengthening local waste-management capability.

From a technical perspective, the selection of rice husk-derived material and cattle manure is plausible because rice husk charcoal can contribute to aeration and porosity while matured cattle

manure can supply organic matter and nutrients. Experimental horticultural studies support the complementary function of these materials, although optimum composition varies by crop and production conditions (Agegnehu et al., 2017; Wartabone et al., 2026). This variation reinforces the need to treat the workshop mixture as a prototype rather than a universally validated formulation.

The longer-term value proposition can be expressed as a circular resource pathway: livestock activity generates cattle manure, agricultural activity generates rice husk, these residues are processed into a horticultural input, and the resulting material may support household cultivation or become a product for local sale. Similar community programmes have identified potential reductions in external input dependence and opportunities for local organic-product development when agricultural residues are processed collectively (Rosnelly et al., 2026; Widyananda et al., 2024). However, no verified sales, packaging activity, production continuity, or household income change was documented in the present programme. Economic contribution must therefore be framed as potential diversification rather than realised income growth.

The waste-valorisation approach also has a meaningful normative connection with Islamic economics. Recent scholarship argues that circular economy principles can be compatible with *maqasid al-Shari'ah* because resource efficiency, waste reduction, environmental protection, and value retention contribute to the protection of life, wealth, and the wider public interest (Afandi & Rahma, 2025). Septiani et al. (2026) similarly link circular value loops with Islamic economic principles and sustainable production.

Within this assisted-community context, the Islamic economic interpretation should remain proportionate to the evidence. The available documentation does not show that concepts such as *israf*, *maslahah*, or *hifz al-bi'ah* were explicitly measured among participants. Rather, these concepts help explain why productive reuse of local residues is compatible with the broader ethos of a Sharia-oriented community empowerment programme. Reusing materials that would otherwise be discarded can be interpreted as responsible stewardship, avoidance of unnecessary waste, and creation of benefit from existing resources. The practical economic significance lies in turning a disposal problem into a possible input for food production and small-scale enterprise.

A stronger second-stage programme should therefore combine technical standardisation with business validation. The growing medium should be tested using selected horticultural crops, with simple indicators such as germination rate, plant height, leaf number, fresh weight, pH, and moisture retention. A standard formulation should then be documented, costed, packaged, and compared with locally available commercial media. On the empowerment side, a paired pre-test and post-test should be used, followed by an adoption check several weeks later. If residents begin producing the medium independently, subsequent evaluation can examine production volume, household cost savings, sales, repeat customers, and contribution to income. This sequence would convert the current capacity-building intervention into a measurable circular micro-enterprise pathway.

## 5. Conclusion

The community service initiative demonstrates a contextually relevant approach to rural empowerment by connecting livestock and agricultural residues with horticultural input production. Through a mini-workshop, leaflet-assisted education, baseline assessment, explanation, and hands-on mixing, community participants gained direct exposure to the process of converting rice husk-derived material and cattle manure-based organic material into a

growing-medium prototype. The strength of the activity lies in its use of locally available resources and in its participatory rather than purely instructional format.

The programme should nevertheless be interpreted as an initial capacity-building and waste-valorisation intervention. The available evidence does not yet demonstrate knowledge gain through paired testing, agronomic performance of the medium, continued household adoption, commercial sales, or increased income. Its principal contribution is therefore the establishment of a practical pathway through which local residues may be transformed into productive horticultural inputs and, with further validation, into a potential source of economic diversification. Future implementation should standardise the formulation, evaluate crop performance, conduct paired pre-test and post-test measurement, and follow participants through product use and market testing. Such follow-up would provide the evidence required to move from promising circular practice to demonstrable rural economic impact.

## References

- Agegnehu, G., Srivastava, A. K., & Bird, M. I. (2017). The role of biochar and biochar-compost in improving soil quality and crop performance: A review. *Applied Soil Ecology*, 119, 156-170. <https://doi.org/10.1016/j.apsoil.2017.06.008>
- Afandi, M. Y., & Rahma, N. (2025). Circular economy and Maqasid al-Shari'ah: A conceptual framework for Islamic economic reform. *Global Review of Islamic Economics and Business*, 13(2), 135-153. <https://doi.org/10.14421/grieb.2025.132-03>
- Alam, S., Ginting, S., Halim, Hasid, R., Namriah, Rustam, L. O., & Pebriansyah, R. (2023). Production of local resource-based soil improvement materials as a community empowerment model in Sindangkasih Village, South Konawe. *Community Empowerment*, 8(11), 1793-1801. <https://doi.org/10.31603/ce.10446>
- Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The circular economy: A new sustainability paradigm? *Journal of Cleaner Production*, 143, 757-768. <https://doi.org/10.1016/j.jclepro.2016.12.048>
- Ndiwa, A. S. S., Oematan, S. S., Airthur, M. M., & Damawi, A. S. (2022). Pengaruh kombinasi komposisi media tanam tanah, arang sekam, dan pupuk kandang kotoran sapi terhadap pertumbuhan dan hasil tanaman sawi (*Brassica juncea* L.). *Wana Lestari*, 4(2). <https://doi.org/10.35508/wanalestari.v7i02.9456>
- Rosnelly, C. M., Fathanah, U., Zuhra, Mulyati, S., Lubis, M. R., Syamsuddin, Y., Yunardi, Nasrullah, R. C. L., Sofyana, Aprilia, S., Suparno, & Priyanto, W. (2026). Transformasi limbah sekam padi menjadi pupuk organik melalui pendekatan partisipatif sebagai strategi pengembangan desa mandiri pangan. *Jurnal Vokasi*, 10(1), 79-88. <https://doi.org/10.30811/vokasi.v10i1.8870>
- Septiani, T., Fadhila, I., Monasdir, & Adelta, K. B. (2026). The circular economy from the perspective of Islamic economics: Advancing a sustainable halal production model. *Halal Studies and Society*, 3(1), 1-5. <https://doi.org/10.29244/hass.3.1.1-5>
- Wartabone, S., Musa, N., Rosdiana, & Yamin, M. (2026). Pengaruh kombinasi media tanam pupuk kandang sapi dan arang sekam terhadap pertumbuhan dan hasil tanaman sawi (*Brassica juncea* L.). *Perbal: Jurnal Pertanian Berkelanjutan*, 14(1), 108-116. <https://doi.org/10.30605/perbal.v14i1.8072>
- Widyananda, C. S., Hadi, A., Shamad, Z., & Hidayati, N. (2024). Pemanfaatan sekam padi dan kotoran sapi sebagai bahan pembuatan pupuk organik padat di Desa Jarin Kecamatan Pademawu. *Darmabakti: Jurnal Pengabdian dan Pemberdayaan Masyarakat*, 5(1), 46-52. <https://doi.org/10.31102/darmabakti.2024.5.01.46-52>