



## FOREST POLICY TRADE AND FINANCE INITIATIVE

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# LEGACIES AFTER THE GOLDEN HARVESTS: WHO IS RESPONSIBLE FOR AGRICULTURAL WASTE?

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### SUMMARY

Agricultural waste in the Central Highlands is often seen as a consequence of farmers' "awareness." A closer look, however, shows that the problem lies in a broken system - one in which collection, transport and treatment have not been designed and operated in a coordinated manner.

From this perspective, agricultural waste is not simply "waste," but can be understood as a legacy of production - residual materials that remain in soil, water and ecosystems, creating environmental and social costs that are not fully reflected in product prices.

Under this approach, agricultural waste is not caused by a single actor, but is the result of an incomplete structure of responsibility. In practice, waste-treatment costs are not properly allocated across the value chain; instead, much of the burden is shifted to farmers and the environment, while Extended Producer Responsibility (EPR) has yet to be implemented deeply enough to drive change on the ground.

On that basis, this paper proposes reframing agricultural waste as a systems issue - one that requires redesigning the value chain so responsibility is integrated throughout the product life cycle, treatment costs are fully accounted for, and those costs are fairly distributed among actors.

Addressing waste, therefore, is not only about solving an environmental problem; it also means restructuring the way the production system operates toward greater sustainability. A production system can hardly be considered sustainable if it measures only output while ignoring what it leaves behind in the soil and the environment.



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**INTRODUCTION: LEGACIES AFTER THE GOLDEN HARVESTS**

In the Central Highlands, what remains after each harvest is not only a figure for yield or profit. Look more closely and quiet legacies emerge: thousands of tonnes of pesticide bottles and packaging, and fertilizer bags left along hillsides, stream banks or in overflowing collection tanks.

Why call them "legacies"? Framed this way, agricultural waste is not simply "rubbish" that can be cleaned up and forgotten. It reflects a form of lasting damage that seeps into the ecological "body." Toxic chemicals from discarded packaging do not disappear; they gradually erode soil health, degrade water quality and leave biological "scars" that persist across many seasons.

Yet for many years, this reality has often been explained by the single idea of "awareness," ending with farmers being blamed. In practice, farmers do collect waste voluntarily when collection tanks are available. What is happening on the ground shows that the problem lies not only in awareness, but more deeply in a broken system - tanks fill up but no one comes to empty them; collection points exist, while final treatment remains unresolved.

Year after year, a little more waste accumulates. The build-up is slow enough to be overlooked, yet large enough to create a paradox: the greater the "golden harvests," the thicker the toxic legacy becomes, quietly eroding the ecological foundation that sustains us. So who is truly responsible for the legacy left after each harvest?



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## 1. THE "LEGACIES" MISSING FROM REPORTS

**...we dwell on figures for yield, output, revenue and profit, while easily overlooking what lies behind the golden harvests - how many tonnes of inorganic fertilizer, pesticides and herbicides have been put into production.**

When a phenomenon becomes familiar, it gradually stops receiving the attention it deserves. The "legacies after the golden harvests" rarely appear in year-end reports, where attractive figures on yield and output create a sense of completion. Step outside the tables, however, and the field tells a different story. Behind impressive export-growth figures lies a paradox: the larger the "golden harvest," the greater the toxic legacy accumulating in ecosystems.

According to the 2023 National State of the Environment Report by the Ministry of Natural Resources and Environment (now the Ministry of Agriculture and Environment), crop production in Viet Nam generates hundreds of thousands of tonnes of solid waste each year, including tens of thousands of tonnes of pesticide packaging. The coffee sector alone generates about 2,150 tonnes of packaging annually. The five Central Highlands provinces<sup>1</sup> account for more than 90% of the country's coffee area<sup>2</sup>, and the region is estimated to bear nearly 2,000 tonnes of pesticide packaging each year. Yet the share collected and treated in accordance with regulations is generally below 30%, and in some places below 10%. This means a very large share of packaging generated each year never enters the formal collection system and therefore does not appear in treatment statistics. The remainder - even when collected - reveals another paradox when we examine how the system handles what it receives.

Annual reports often dwell on yield, output, revenue and profit, while easily overlooking the figures that lie behind the golden harvests - how many tonnes of inorganic fertilizer, pesticides and herbicides have been put into production. We record input costs and output productivity in great detail, yet leave blank the figure for bottles still lying in the fields. Agricultural performance therefore needs a different approach - one based not only on output, but also on the waste generated and the capacity of soil to sustain life.

From this perspective, the issue is not simply littering; it is that the end of the product life cycle has not been fully considered. When fertilizers and pesticides are brought into the field, the question of where bottles and packaging will go after use still appears to be left unanswered.

This is the real gap in the design and operation of the production cycle in practice - and it is this gap that deserves attention.

<sup>1</sup> Provinces in the Central Highlands before the July 2025 administrative merger: Kon Tum, Gia Lai, Dak Lak, Dak Nong and Lam Dong.  
<sup>2</sup> Dak Lak: about 215,000 ha; Lam Dong: about 165,000 ha; Dak Nong: about 140,000 ha; Gia Lai: about 105,000 ha; Kon Tum: more than 30,000 ha.



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## 2. FROM THE FIELD: QUESTIONS STILL UNANSWERED

People's practices have changed, but the supporting system behind them has not been built in a coordinated way, leaving major questions hanging over the Central Highlands.

During a field trip in Dak Lak, I asked a farmer how he disposed of pesticide bottles. He replied: "I just collect them there - where else am I supposed to take them?" The answer sounds simple, but it contains difficult questions that reality has yet to answer satisfactorily:

First, where is the outlet? When collection tanks are full and no vehicle comes for months or even years, where does the farmer's correct action lead? Are we focusing on encouraging collection while overlooking the system's capacity to transport and treat the waste?

Second, is the risk disappearing or merely shifting? Waste does not disappear; it simply moves from being dispersed to being concentrated in piles. When final treatment is unresolved, we inadvertently create "concentrated pockets of toxins" that slowly seep into soil and water at collection sites.

Third, who pays for the final link? Collection tanks may be financed through social contributions, but funding for transporting and destroying hazardous waste remains a "gap" with no clear revenue or expenditure source, causing blockages in the treatment flow.

These questions point to the core bottleneck: a fragmented management system. Without a real "outlet" for the waste, every effort to raise awareness ultimately reaches a dead end.

In several key coffee-growing communes in Dak Lak, pesticide-packaging collection tanks built under earlier support programmes became overloaded after only one or two harvests. Nationwide, tens of thousands of collection tanks have been installed, yet they still do not meet demand. At many sites, hundreds of kilograms of bottles and packaging remain for months or even years because no operator collects them regularly. Meanwhile, farmers continue to put waste into the tanks as instructed, unintentionally turning them into open-air "temporary storage facilities." The problem does not lie in farmer behavior. The system has addressed only the symptom - collection - while leaving the root problem - final treatment - unresolved.



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### 3. THE PROBLEM IS NOT "AWARENESS"

...the core problem lies in the system's "gaps" - too few nearby collection points, no regular transport schedule, and insufficient coordination and shared responsibility among stakeholders.

Sometimes the problem lies not in what people do, but in how we understand it. For years, discussions of agricultural waste have often "assumed" that the fault lies with "people's awareness." This view is easy to accept because it places responsibility on the last link in the value chain.

Look more closely and farmers are the last people holding the empty bottle, but they are not the ones who created it. They pay for pesticides and fertilizers - solutions to protect crops and nourish plants - not to shoulder what remains of the product: a "legacy" over which they had no choice from the outset.

From this reality, one point becomes increasingly clear: the core problem lies in the system's "gaps" - too few nearby collection points, no regular transport schedule, and insufficient coordination and shared responsibility among stakeholders.

Farmers cannot build hazardous-waste treatment plants themselves. They can only do their part well if the entire system behind them is organized properly.

The issue, therefore, does not lie entirely in "awareness," but in system design: are infrastructure and services convenient enough for people to fulfill their responsibilities as easily as possible? When doing the right thing becomes too difficult, the fault no longer lies with them. When our perspective fails to reach the heart of the problem, responsibility will continue to be misplaced, and the agricultural-waste problem will persist.

Under the current structure, farmers are both product users and the people who must bear the final consequences of decisions made further upstream, where they have no voice.



Photo 3. Department leaders and farmers test an environmentally friendly biological product that is safe for people and crops. Photo: Pham Tuan Anh.



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## 4. THE VALUE CHAIN AND THE BREAK IN RESPONSIBILITY

**That break is not only a management problem; it also creates an unrecorded cost - "environmental bills" quietly accumulating in the fields, waiting to be paid by the soil and water themselves.**

Viewed through the value-chain structure, every agricultural-input package is part of a complete operating cycle: from production and distribution to the farmer. Throughout that process, the product's value is captured, transformed and fully recorded. Yet there is a striking reality: once its useful life ends, once the "golden harvest" is over, responsibility for what remains of the product appears to be completely severed.

Producers earn profits and dealers receive commissions, while the toxic "tail" is shifted to the environment, communities and local authorities. No explicit decision authorizes this transfer, yet it recurs season after season.

It is in this context that Extended Producer Responsibility (EPR13) was designed as a mechanism to restore the integrity of the value chain. In principle, EPR means that a company's responsibility does not end at the point of sale, but extends through the end of the product life cycle - including collection and treatment of discarded materials. Each product sold therefore carries not only its use value, but also the cost of dealing with what remains.

In practice, however, this mechanism has yet to operate fully. Although EPR has been introduced, substantive business participation remains limited and changes on the ground are still unclear. This suggests that the issue is not simply whether a regulation exists, but how that regulation is designed and implemented.

A major bottleneck lies in the financing mechanism. When company contributions do not fully reflect the actual costs of collection and treatment, the system can satisfy obligations on paper without generating enough resources to operate in practice. At a deeper level, financial responsibility is not yet tied to the places where waste is actually generated. When funds do not return to localities - where collection tanks fill day by day - and transparent allocation mechanisms are lacking, stable collection and treatment are difficult to sustain.

That break is not only a management problem; it also creates an unrecorded form of cost - "environmental bills" quietly accumulating in the fields, waiting to be paid by the soil and water themselves.



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## 5. "ENVIRONMENTAL BILLS": THE FORGOTTEN COSTS

Those costs are very tangible: declining water quality, eroding soil fertility and health risks faced by local communities.

Every bottle or agricultural-input package left on the land can be seen as an "environmental bill" - a treatment cost that has already arisen but has not yet been paid. It is the cost of collecting, transporting and safely treating hazardous waste so that it does not continue to damage soil, water and ecosystems.

In principle, these costs should be built into the product price from the outset as an inseparable part of its life cycle. In practice, when that mechanism is not fully implemented, consumers pay only for the product's use value while treatment costs are left behind. The "environmental bills" do not disappear; they are transferred to the environment and communities to bear.

From this perspective, agricultural waste is no longer merely a story about discarded objects, but a sign of costs that are "hidden" within the system. Those costs are very tangible: declining water quality, eroding soil fertility and health risks faced by local communities.

If the previous discussion shows that a large share of waste never enters the system, the reverse is also true: even the waste that is collected exposes clear limits in the system's treatment capacity. A synthesis of reports from the Ministry of Natural Resources and Environment and several localities for 2022-2024 shows that nearly 2,500 tonnes of used pesticide packaging were collected nationwide. Even compared with annual generation measured in the tens of thousands of tonnes, this indicates that only a small share of waste enters the formal collection system. Of that amount, only about 1,400 tonnes were treated in accordance with regulations; more than 500 tonnes were disposed of by residents themselves, usually by burning; and more than 550 tonnes remained at collection sites or in the environment.



Photo 4: Agricultural waste dumped in a forest. Source: Ngai Lao Dong Newspaper



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The remaining stock is not merely waste; it represents untreated environmental costs that continue to accumulate from one season to the next.

These figures do not represent the full amount generated; they show only the portion of waste that entered the formal collection system. More strikingly, even this portion has not been fully treated.

When "environmental bills" are not properly recognized and paid, the production system operates with an "artificial price" - real costs are concealed, and profit is created partly by shifting the burden into the future. Over time, this weakens the ecological foundation on which agricultural production depends.

Viewed this way, addressing agricultural waste is not merely about solving an environmental problem. It means returning these forgotten "bills" to their proper place in the system - as costs that must be recognized, allocated and paid fairly.

In other words, today's agricultural commodity prices reflect only direct production costs and do not yet fully include the environmental costs that the production system is passing on to the future.



Photo 5: An avocado orchard managed under organic practices. Photo: Pham Tuan Anh.



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## 6. WHAT WAY FORWARD FOR THESE "ENVIRONMENTAL BILLS"?

**If every dealer becomes a take-back point, collection and treatment will have a clear outlet.**

International experience shows that when responsibility is designed across the full product life cycle and linked to a clear financing mechanism, recovery rates for agricultural packaging can be very high - in many cases above 80-90%.

In Brazil, the Campo Limpo programme has achieved packaging recovery rates above 90% through close coordination among producers, distributors and farmers. Used bottles are no longer treated as waste, but as a "mandatory condition" in the next purchase cycle.

In Germany, the PAMIRA system collects tens of thousands of tonnes of containers each year through a network closely linked to retailers, where farmers can return empty containers easily, conveniently and free of charge.

What these models share is that responsibility is directly linked to the distribution system and financial flows are managed transparently.

For Viet Nam, there is no need to wait for perfectly synchronized infrastructure. What is needed is a clear financing mechanism and binding responsibility from the outset: every company and producer must bear a specific, transparent responsibility for the "environmental bills" they release onto the market.

The agricultural-input dealer network already spread across the Central Highlands is an existing "circulatory system" through which this model can operate. If every dealer becomes a take-back point, collection and treatment will have a clear outlet. Only when EPR financing is unlocked to pay substantively for transport and treatment can the current situation - "collection points exist, but the treatment flow is blocked" - finally end.



Photo 6: Pesticide and fertilizer retailer in the Central Highlands. Source: Lương Kim Anh



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## 7. FROM WASTE TO RESPONSIBILITY FOR THE LAND

**When farmers begin asking where the inputs they use come from and what they leave behind after each harvest, they become actors capable of reshaping the input market.**

As export markets tighten requirements on transparency and sustainability, unresolved "environmental bills" are no longer only a domestic issue. Although not yet a direct criterion, they may become a compliance risk under international regulations such as the EUDR, as traceability and environmental-responsibility requirements continue to expand.

More broadly, agricultural-waste management is not merely an end-of-chain treatment issue; it concerns how the entire production system is designed from the outset.

In that sense, waste management is not only about treating what has already been generated, but also about minimizing waste at source. This shift also calls for a different perspective: responsibility for waste lies not only in treatment, but throughout the entire production process.

At the same time, this creates a new expectation for farmers - not only as producers, but also as responsible consumers in choosing inputs and production practices. Waste management then becomes not an external requirement, but part of how they protect product value and their own production environment.

When farmers begin asking questions about what they use - where it comes from and what it leaves behind after each harvest - they are no longer merely producers, but actors capable of reshaping the input market. Even small changes from farmers can exert pressure back through the entire value chain.



Photo 7: Coffee farmer in Dak Lak. Source: Forest Trends



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## 8. REDESIGNING THE SYSTEM: WHO SHARES RESPONSIBILITY?

From a systems perspective, the question "Who is responsible for agricultural waste?" cannot be answered by naming a single actor; it must be considered across the entire value chain. In that structure, businesses play the central role in organizing and financing collection and treatment; government establishes the institutional framework and ensures enforcement; dealers and cooperatives serve as intermediaries; and farmers are the direct users who ultimately experience the system's impacts.

Under this approach, EPR is not merely a financial obligation; it must be designed as a genuine operating mechanism. When collection and treatment costs are fully and accurately calculated and incorporated into product value from the outset, the "tail" of the product life cycle will no longer be forgotten.

An independent monitoring mechanism is also needed, with participation from local institutions such as cooperatives and communities, to verify that collection, transport and treatment are carried out as committed. Only then can EPR move from "compliance on paper" to change on the ground.

In addition, product-life-cycle traceability tools - such as QR codes or an "environmental passport" - can help make material flows and each actor's responsibilities more transparent. When every package carries a traceable "footprint," collection and treatment no longer depend entirely on behavior-change campaigns, but become a controllable part of the system.



Photo 8: QR code for product traceability on agricultural produce. Source: Vietnam Pictorial



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## HOW WOULD A "QR / ENVIRONMENTAL PASSPORT" MECHANISM WORK?

A life-cycle traceability system for agricultural-input packaging can be designed as an "environmental passport," in which each product unit (or batch) is assigned a unique identifier (QR code) that allows tracking from distribution through take-back and treatment.

In principle, the mechanism has three main layers:



1

### Tagging at source (upstream tagging)

At the production or import stage, each package is assigned a QR code containing basic information: producer, product type, date placed on the market and the entity responsible for EPR. The code travels with the product throughout the distribution chain to the farmer without changing how the product is used.

2

### Recording at the take-back point (downstream capture)

When used packaging is brought to a take-back point (dealer, cooperative or collection site), the QR code is scanned to record the return. Data are updated in a central system, allowing the quantity returned, place of generation and responsibility of each company to be identified. The record can be linked to incentives - such as a deposit refund or points - to encourage users to return packaging.

3

### Verification and confirmation of treatment (verification layer)

After collection, waste batches are transported to a treatment operator. Receipt and treatment are confirmed through the system, creating a closed data chain from "placed on the market" to "final treatment." Regulators and independent monitors can use these data to reconcile EPR obligations instead of relying only on self-declared reports.

From a systems perspective, an "environmental passport" is not merely a technical tool, but a mechanism for clarifying responsibility. When every package leaves a traceable "footprint," material flows and financial flows must meet at the end of the product life cycle. Even with such traceability tools, however, the core challenge remains the institutional design and financing mechanism of the system.



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Redesigning this system is not simple. It requires changing how costs are allocated across the entire value chain, while establishing sufficiently strong binding mechanisms to ensure substantive business participation. Without transparency and effective oversight, EPR can easily revert to a formality, while the treatment burden continues to fall on farmers and the environment.

In that sense, the solution is not simply to add more collection points, but to establish a closed-loop operating mechanism in which material and financial flows are connected throughout the product life cycle.

Specifically, action can proceed in three main directions:

First, businesses should fulfill EPR responsibility not only through financial obligations, but by directly organizing or contracting local collection and treatment systems.

Second, local authorities and cooperatives should play coordination and independent-verification roles, overseeing collection and treatment so material and financial flows are substantively connected.

Third, agricultural-input dealer networks should be standardized and formally integrated as take-back points, creating a clear and convenient outlet for post-use waste.

From this perspective, redesigning the system goes beyond technical solutions and raises policy questions that require further discussion:

Should businesses be required not only to meet financial obligations, but also to directly organize or participate in operating collection and treatment systems on the ground? Could agricultural-input dealers be designed as "mandatory take-back points"?

Should packaging-treatment costs also be integrated as a mandatory component of input prices from the outset, or through mechanisms such as deposit-refund systems, to create stronger incentives for effective recovery?

Are these "legacies" affecting, even indirectly, product quality and supply-chain safety?

And as international standards continue to expand - for example, if markets such as the EU begin considering a "pollution footprint" - are production regions such as the Central Highlands truly ready?

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### IN PLACE OF A CONCLUSION

The analysis above shows that agricultural waste is not merely a question of treatment; it is about how the entire production system is designed and operated.

The question "who is responsible for agricultural waste?" therefore cannot be answered by identifying a single actor.

Responsibility belongs to the whole system, but it is not distributed equally: businesses must play the central role in organizing and financing the product life cycle; the State is responsible for designing and enforcing institutions; and farmers can only fulfill their part when the necessary system conditions are in place.

When this structure of responsibility is not clearly established, what remains is automatically shifted to the environment - which has no mechanism to refuse it.

When "environmental bills" are fully recognized and addressed, a different rural Central Highlands can be imagined - one where production is no longer accompanied by residues that are difficult to handle.

Ultimately, effective waste management does not begin only at the treatment stage. It starts with reducing waste generation at source - by shifting production decisions toward less dependence on chemicals.

If the "legacy" remains after every golden harvest, then every claim of "sustainability" remains incomplete.

