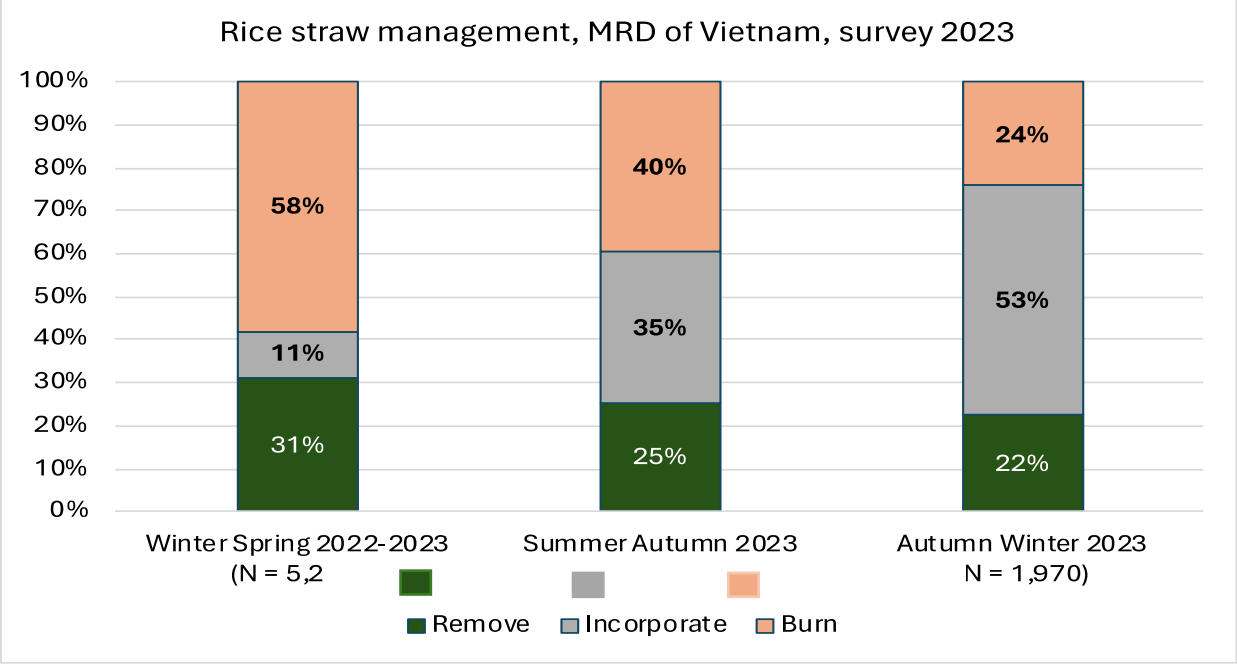
POLICY BRIEF 1: CURRENT STRAW MANAGEMENT PRACTICES IN VIETNAM[1]

1. General overview

The study by Phùng Chí Sỹ and colleagues (2024) estimated that in 2020, the total amount of straw generated from rice production was approximately 150 million tons, with the majority concentrated in the Mekong Delta (accounting for 55.72%), followed by the North Central region (accounting for 15.66%) and the Red River Delta (accounting for 14.11%). A large amount of straw is currently still being disposed of by burning. The proportion of straw burned in the fields varies greatly, ranging from 20-80% (Phùng Chí Sỹ et al., 2024). In some areas, such as the outskirts of Thái Bình City, where combine harvesters are used, the burning rate during the harvest season can reach up to 90% (Hoàng Anh Lê et al., 2013). The burning rate in the Mekong Delta remains quite high, with about 55% of the generated straw being burned (Phạm Thị Hồng Phương, 2023).

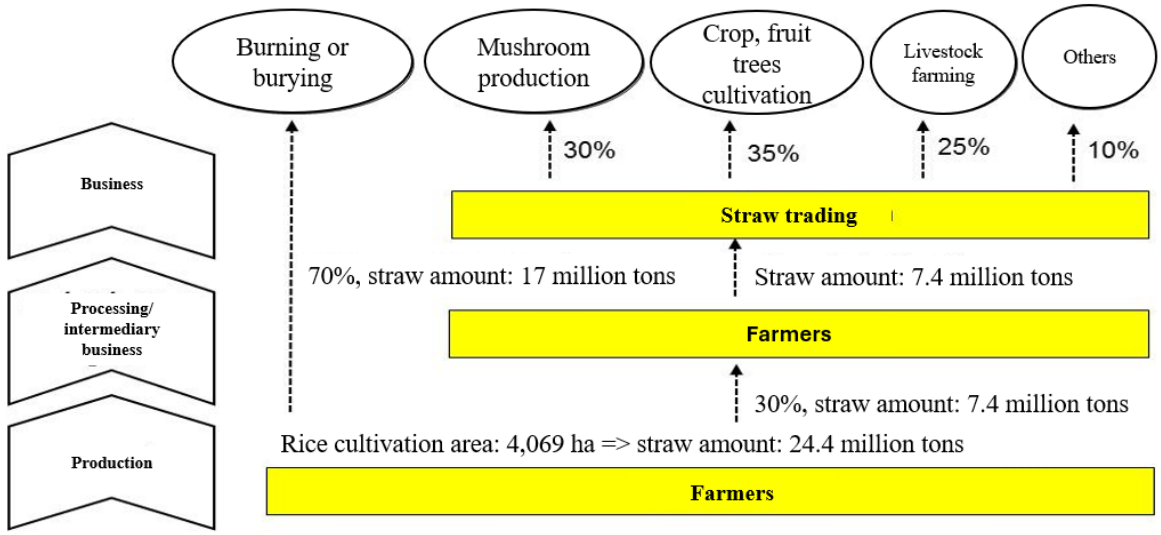
Figure 1: Straw Management in the Mekong Delta Region of Vietnam, Survey 2023 (Conducted by IRRI)



[1] **This policy brief was elaborated under the FFU project entitled "Energy transition and climate-smart agriculture in Vietnam (ETCAV)" supported by Danida, DFC journal no.: 24-M02-KU**

Nguồn: Điều tra 10.000 ND ĐBSCL, IRRI (2024).

Figure 2: Rice straw management



Source: Canh Dung et al., 2021.

According to the Department of Crop Production (under MARD of Vietnam), approximately 47 million tons of straw are generated annually from rice production in Vietnam. Of this, only 30% is collected and reused for purposes such as mushroom cultivation, animal feed, and padding for fruit transportation. The remaining straw is primarily burned or buried in the fields[2].

The open burning of agricultural residues, especially straw, releases large amounts of emissions and fine particulate matter, contributing to environmental pollution, increasing the risk of climate change, and posing long-term health risks to the community due to the potential generation of persistent organic pollutants. Burning straw leads to nutrient loss, reduced biodiversity, and environmental pollution. The emissions, fine particles, and heat produced during straw burning accelerate climate change and contribute to various respiratory and cardiovascular diseases in humans. Burying straw in wet fields can at least double greenhouse gas emissions.

Vietnam has issued several policies aimed at promoting the transition to a circular economy, encouraging the reuse of by-products, and limiting the burning of agricultural

[2] https://thuvien.mard.gov.vn/san-pham/gioi-thieu-sach/so-tay-huong-dan-quan-ly-rom-ra-theo-huong-nong-nghiep-tuan-hoan-va-phat-thai-thap-o-dong-bang-song-cuu-long-17168/

residues (such as straw recycling) to protect the environment and effectively utilize these by-products. Key policies include the Circular Economy Development Plan in Vietnam (Decision No. 687/QĐ-TTg dated June 7, 2022) and the Plan for the Development and Application of Science and Technology to Promote the Circular Economy in Agriculture by 2030, which aims to collect and reuse 80% of straw (Decision No. 540/QĐ-TTg dated June 19, 2024).

Vietnam has also issued several regulations related to the management and use of by-products, particularly in agriculture. These include Circular No. 19 of 2019, which provides regulations on the collection, treatment, and use of agricultural residues, and Decree No. 45 of 2022, which outlines penalties for administrative violations in the field of environmental protection.

To mitigate the straw burning, the Ministry of Agriculture and Rural Development, along with provincial authorities, has intensified efforts to raise awareness about the harmful effects of burning straw in the fields. They have promoted the application of biological products to manage straw after harvest and regularly conducted inspections while encouraging the reuse of straw for other productive purposes. Various models for recycling and reusing straw have been introduced to farmers, such as processing straw into organic fertilizer, using straw to support fishpond farming, and employing straw in mushroom production, among others. However, the adoption of these measures remains limited, with the models being implemented only in certain small-scale production areas. The role of local authorities has not been strong enough in supporting farmers to adopt straw management techniques after production. For farmers, burning straw is a long-standing practice, and they have little motivation to adopt alternative techniques due to the high costs and low perceived benefits.

2. Some regulations related to the management and treatment of straw in Vietnam

- *Managing and using by-products to avoiding environmental pollution:*

The Environmental Protection Law 2020 (Law No. 72/2020/QH14 dated November 17, 2020) stipulates in Clause 4, Article 61, that agricultural by-products must be collected for the production of goods, used as raw materials, fuel, fertilizer production, energy production, or must be treated according to regulations; open burning of crop by-products that causes environmental pollution is prohibited. Article 61 also states that the government encourages models for the reuse of crop by-products to develop organic and environmentally friendly agriculture.

- *Penalties for the violations of burning straw causing environmental pollution:*

Decree No. 45/2022/ND-CP on July 7, 2022: This decree concerns penalties for administrative violations in environmental protection. It includes provisions related to the illegal burning of straw in the fields, establishing fines and other penalties for such activities.

Clause 1, Article 41 of Decree No. 45/2022/ND-CP regulates penalties for administrative violations in the field of environmental protection, states that the act of burning straw (open burning of crop by-products near residential areas, airports, and major transportation routes) constitutes a violation of environmental protection regulations in agricultural production. The fines range from VND 2,500,000 to VND 3,000,000. These fines apply to individuals, households, business households, and community groups in violation. If an organization commits the same violation, the fine is doubled compared to that for individuals.

- *Interventions/Initiatives by the Ministry of Agriculture and Rural Development and the Government:*

+ **Circular No. 19/2019/TT-BNNPTNT**: Issued by the Ministry of Agriculture and Rural Development, this circular provides guidelines on the collection, treatment, and use of agricultural residues, including straw. It outlines methods for recycling and reusing straw in an environmentally friendly manner.

Crop residues have to be collected and sorted according to their intended use. The collection and transportation of crop residues should not disrupt agricultural activities in the cultivation area, traffic, or cause environmental pollution and the spread of pests. Advanced techniques in harvesting and collecting crop residues are encouraged, as well as the use of pressing and compacting technologies before transportation. Residues and by-products from areas affected by plant pests must be managed in accordance with plant protection and quarantine regulations. The use of biological products and the application of technological advances and new techniques in the treatment of crop residues are also encouraged. The treatment of crop residues should ensure that it does not cause environmental pollution or facilitate the spread of pests.

+ **Decision No. 540/QĐ-TTg (2024):** This decision sets forth a plan to promote the development and application of science and technology for a circular economy in agriculture by 2030. It aims to ensure that 80% of straw is collected and reused, rather than being burned or discarded.

+ **Decision No. 687/QĐ-TTg (2022):** This decision outlines the Circular Economy Development Plan in Vietnam, encouraging the reuse of agricultural by-products, including straw, to minimize waste and environmental pollution.

+ The Department of Crop Production, with the support of CGIAR and IRRI, has developed and published the guidebook "Straw management for circular agriculture and low emission practices in the Mekong Delta" in 2023. This guidebook promotes straw management within a circular agriculture framework to maximize the nutrients contained in straw, increase its value, and thereby avoid open burning and reduce the practice of burying straw in flooded fields. The goal is to reduce biodiversity loss, environmental pollution, and greenhouse gas emissions, while also increasing income for rice farmers and related commercial production services.

3. Models/Initiatives for Post-Harvest Rice Straw Management

Model 1: Handicrafts production, Bioplastics, and Products for Urban Agriculture

- *Handicrafts production from dried rice straw*

+ Broom-Making Village in An Nghiep Village, Tu Cuong Commune, Thanh Mien District, Hai Duong Province: The raw material for brooms is derived from the straw of sticky rice plants following the harvest. 1 sào (a traditional Vietnamese unit of area; 1 sào=360m^2) of sticky rice yields 25 kg of dry straw cores, which can be used to make 40 brooms. The retail price for each broom made from straw is 30,000-35,000 VND. The broom-making craft provides employment opportunities and a stable income for many workers during the off-season, contributing to the local socio-economic development. The broom-making model is also in operation in Nghia Loi Commune, Nghia Hung District, Nam Dinh Province.

+ In Binh Giang District, Hai Duong Province: Farmers have used machinery to roll straw into small fibers, which are then woven into strings. The straw strings are the primary material used in the production of hats, bags, and other accessories. The straw is then woven into a variety of products, including mats, wall hangings, and decorative household items. Straw braids are supplied to Japanese partners.

+ **Broom-Making Model in Tan Son 2 Hamlet, Tan Dinh Commune, Lang Giang District, Bac Giang Province:** After harvesting sticky rice, the households dry and bundle the straw. Typically, five bundles of straw are woven into one thick broom. On average,

households in the commune sell 500-600 brooms annually, with each broom priced at 30,000 VND.[3]

+ **Model "The Brush 3S":** Effective Livelihood Model for Women and Girls Implemented by the Su Phì District Women's Union in Ha Giang Province in Collaboration with Plan Organization. The 3S Broom Production Group in Tan Tien Commune was established in August 2021 with a membership of 20 individuals, all of whom were women between the ages of 18 and 30. The Plan organization provided assistance to the model in the form of facility renovation and the provision of initial raw materials, valued at approximately 200 million VND. The material utilized in the production of these goods is sticky rice straw, which is repurposed from agricultural by-products. The 3S Broom Production Group has sold over 2,700 brooms, generating nearly 90 million VND in revenue. The 3S group currently produces two types of brooms: long and short brooms, with an average income of 2-3 million VND per month.The handicraf products have been sold in Ho Chi Minh city, Dak Lak, Thai Nguyen, Hoa Binh, Ha Noi...

[3] (https://baobacgiang.vn/bien-rom-ra-thanh-tien.bbg)

- *Using straw as a plastic substitute:*

At present, the International Rice Research Institute (IRRI) and Rynan Vietnam have developed a technology for the production of seedling pots and office plant or flowerpots, which serve as viable alternatives to plastic pots and other conventional materials. These products satisfy the demand for environmentally friendly alternatives, reduce environmental pollution, and enhance the value of straw, thereby increasing the income of farmers and related commercial production services. This section will present the technology process for the production of pots from straw, as developed by IRRI and

Rynan Vietnam.

- The utilization of rice straw as a protective layer for fragile items or as a lining material in fruit boxes during long-distance transportation is a common practice. The quantity of straw utilized for this process is insignificant.

Model 2: Using rice Straw for Mushroom Cultivation and as a substrates for growing mushrooms

+ The Tuấn Hiệp Mushroom Cooperative exploits the surplus straw in the local area to cultivate mushrooms. The cultivation medium is composed of 80% straw and 20% rubber sawdust or acacia wood chips. The cooperative currently operates on a production area of

3,000 square meters. In 2021, the cooperative had six products designated as 3-star OCOP (One Commune One Product) by Nam Dinh Province, including brown oyster mushrooms, white oyster mushrooms, shredded wood ear mushrooms, lingzhi mushrooms, mushroom spring rolls, and mushroom sausage. In 2024, the cooperative introduced approximately 50 tons of various mushrooms to the market. The average selling price of each type of mushroom ranges from 35,000 to 40,000 VND per kilogram, while mushroom spring rolls and mushroom sausage are priced between 150,000 and 200,000 VND per kilogram. The cooperative generates an annual profit of approximately 2 billion VND. [4].

+ In 2016, the Hanoi Department of Natural Resources and Environment provided guidance to 20 districts, towns, and communes regarding the implementation of measures designed to reduce the burning of straw. Thọ Xuân Commune was one of two pilot communes that implemented the "No Straw Burning Fields" model. Following a two-year implementation period, the commune achieved several successes. In 2017-2018, it was awarded sponsorship for biological products, which enabled the composting of straw into fertilizer. The New Green Farm Cooperative in Can Tho City has successfully implemented a circular model based on the utilization of straw. The cultivation of straw mushrooms indoors constituted an extension of the production chain, thereby increasing farmers' incomes and yielding high economic efficiency. A study revealed that the sale of straw from harvested rice fields yielded a mere 500,000 to 700,000 VND per hectare. However, the implementation of a circular agricultural model, which encompasses the production of organic fertilizers and the cultivation of mushrooms, has the potential to significantly enhance the profitability of cooperative members, with an estimated increase of nearly 50%. The profit margin for growing straw mushrooms is quite high: 10 kg of dry straw can produce 2 kg of mushrooms. –

Model 3: Organic Fertilizer Production Model: Using Biological Products to Process Straw into Organic Fertilizer

[4] https://nhandan.vn/tan-dung-rom-ra-de-san-xuat-cac-san-pham-ocop-chat-luong-cao-post820678.html

From 1 hectare of rice, approximately 10 tons of straw can be converted into around 400 kg of organic fertilizer. According to the national average, with 45 million tons of straw, processing it could yield 20 million tons of organic fertilizer. This reduces the need for farmers to purchase chemical fertilizers, which translates to approximately 200,000 tons of nitrogen, 190,000 tons of phosphorus, and 460,000 tons of potassium, equating to nearly 11 trillion VND in savings. One ton of straw contains approximately 5-8 kg of nitrogen (N), 1.6-2.7 kg of P_2O_5, and 14-20 kg of K_2O. Using straw as fertilizer maximizes nutrient utilization, reduces methane emissions in fields, and increases the value of straw (IRRI, Department of Crop Production – 2023).

Using Biological Products to Compost Straw into Fertilizer Directly in the Field:

Farmers in northern provinces use biological products mixed with straw after preliminary collection in the field to compost organic fertilizer directly on-site. However, this method is time-consuming (taking 20-30 days) and requires significant labor for collection and processing. An alternative is to collect the straw at central points or household locations, then treat it with manure and biological products such as EM or Trichoderma to create fertilizer.

- Project on Correct Fertilizer Use led by the Plant Protection Department (Ministry of Agriculture and Rural Development) and implemented by the International Rice Research Institute (IRRI), focuses on developing and expanding the technique of processing straw into organic fertilizer. The Nam Dinh Department of Agriculture and Rural Development has directed relevant units to build pilot models and scale up the use of mechanized and biological methods for straw processing in the region.

-Vinh Phuc Province Support Program: From 2022 to 2024, the provincial government has provided financial support for using microbial products to process straw. In 2024, Vinh Phuc allocated over 14 billion VND to purchase these products. The Agricultural Promotion Center is the implementing agency, distributing 140,000 kg of microbial products for 5,000 hectares. Key rice-growing districts like Yen Lac and Vinh Tuong receive support for 1,000 hectares, while districts with smaller rice areas such as Binh Xuyen, Song Lo, Tam Dao, Tam Duong, and Lap Thach receive support for 500-750 hectares. Cities like Phuc Yen and Vinh Yen receive support for 100 hectares. The Agricultural Promotion Center also disseminates technical procedures for straw treatment using microbial products. Specifically, after rice harvest, farmers are instructed to maintain water at 2-3 cm in the field, apply lime, use a rotary tiller to break the straw, and then evenly spread 1 kg of microbial product per sào (360 m2). Water level is then increased to 7-10 cm for 10-15 days before plowing, fertilizing, and sowing.

+ 04 Pilot Models for Straw Treatment in 04 Communes (including Duc Hoa và Xuân Thu commue, Soc Son district; Nguyen Trai commune, Thuong Tin district; Phú Nam An commue, Chuong My district, Hanoi province), The four pilot models were implemented from September 15 to November 30, 2018, as part of the "Application of Science and Technology for Processing Straw into Organic Fertilizer" program. This program facilitated the transfer of environmentally friendly straw processing methods to local farmers.

Since 2017, Hanoi has implemented a commune/district model to enforce the prohibition of straw burning in agricultural fields. This initiative has been accompanied by the provision of complimentary biological products, initially to discourage the practice and subsequently to gradually diminish the level of support. Specifically, the "Model of post-harvest straw and rice straw treatment with biological products" was implemented in Dan Phuong district, Hanoi city, in 2017. In the spring of 2019, the district proceeded to replicate the model on a wider scale, extending it to nine communes across an area of 357 hectares. The district provided farmers with free access to biological products and offered technical training. In comparison to fields where straw and rice straw were burned, fields treated with biological products demonstrated a reduction in the necessity for two sprays of pesticides to prevent yellow leaves and physiological root suffocation. Furthermore, the quantity of phosphate fertilizer utilized for basal fertilization and NPK fertilizer for the initial fertilization was diminished by 30%, while the quantity of NPK fertilizer for the initial fertilization was reduced by 15%. Furthermore, the application of biological products for the treatment of straw and stubble after harvest is a relatively straightforward process. The product is simply mixed with sand, soil, or fertilizer and distributed evenly throughout the field. Following a period of 13-15 days, the straw and stubble will have decomposed and become incorporated into the soil. To further replicate the model, the Dan Phuong District Farmers' Association constructed the "Field without straw burning" model at the outset of the 2021 spring rice harvest. In accordance with this approach, the District Farmers' Association devised a plan and collaborated with Cpart Joint Stock Company, the Center for Organic Agriculture - Vietnam Academy of Agriculture, and the Center for Living and Learning for the Environment and Community (Live & Learn) to select four communes in Hong Ha, Lien Hong, Thuong Mo, and Tan Lap for the implementation of the "Solutions to reduce straw and stubble burning" project following the 2021 Spring harvest, spanning an area of 25 hectares.

+ **Bac Giang** provine- Organized by the Farmers' Union of Bac Giang Province, the campaign to promote, guide, and support the use of biological products to process straw into fertilizer has been applied by 500 households in Thai Son Commune on an area of 60 hectares. In this model, the households commit to not burning or burying fresh straw in the

soil or in flooded fields. Instead, they spray the biological products on the rice fields after harvesting, using these products to accelerate the decomposition of straw and create organic matter for the soil. Additionally, the households are guided to use straw as mulch for other crops (such as melons, onions, garlic, potatoes, and fruit trees), which helps retain moisture and improve soil structure. Evaluations have shown that the area applying this farming technique has reduced the use of chemical fertilizers by 20-30%.

Application of Technology Combined with Biological Products for Organic Fertilizer Production from Straw

IRRI and its partners have developed and successfully tested a mechanized technology for producing organic fertilizer from straw in Vietnam. This technology integrates physical (machine mixing), biological (composting methods and decomposition bacteria), and chemical (balancing organic and nitrogen ratios) processes to optimize straw decomposition and enhance the quality of organic fertilizer. The process also utilizes additional agricultural by-products (such as coconut husk, cow manure, and pre-composted straw). Some regions in the Mekong Delta are implementing this technology, but the scale is still limited.

Model 4: Support for agricultural production: mulching for vegetables and fruit trees
Rice straw is used as a mulching material for crops and is widely practiced in many provinces across the country. Using straw to cover the soil around the base of plants helps to: suppress weed germination, retain soil moisture, and maintain soil structure. This method is also practiced in northern and central provinces.

Model 5: Using straw for livestock feedRice straw is a preferred feed for livestock such as buffalo and cattle, as it can be stored for long periods without spoiling. Straw can be dried and bundled into large stacks, or fermented to be used as feed for buffalo and cattle over extended periods. This practice is quite common among small-scale farms in northern and central provinces, where livestock farming is integrated.

Model 6: Collecting Straw for Sale to Traders and Businesses

Farmers in the Mekong Delta and the Red River Delta are collecting straw to sell to traders and businesses. The labor cost for bundling one roll of straw is 8,000 VND, while the selling price of one roll of straw at the field is over 20,000 VND. Additionally, landowners who do not need the straw can sell it for 100,000 - 150,000 VND per hectare.

Model 7: **Burying straw in the fields to enrich soil**

Farmers in some provinces of the Mekong Delta somtimes bury straw in the fields before plowing, with the expectation of enriching the soil. The practice of burying straw combined

with soaking in water helps to decompose the straw more quickly. However, this method is currently discouraged due to its environmental impact, particularly in increasing methane (CH4) emissions. Additionally, it can negatively affect the growth of rice plants in subsequent growing seasons, leading many regions to reduce or eliminate this practice.

Case: Burning Straw in Fields Affected by Major Pest Outbreaks (to Eliminate Insects)

- Burning straw in certain production areas may be permitted when the area is experiencing a significant pest outbreak affecting rice crops. This practice can help eliminate eggs and pathogens in some cases.

Some other creative ideas from other straw (but not really developed in Vietnam):

- Ongoing research idea by a student research group: “development of nano-biological films from straw for use in b-mask production.”
- Production of "chopped straw": providing chopped straw for use in feeding insects like mudskippers and crabs.
- Production of waterproof paper products: manufacturing waterproof paper, plates, cups, and boxes from straw; production of paper pulp from straw.

Other business models from rice straw:

- **Straw weaving model (using straw from young rice plants) for craft products in Tan Thanh Commune, Kim Son District, Ninh Binh Province**: The primary material for making "trâu tails" (a type of craft item) is the stems of fragrant eight-grain rice plants. After about 45 days of growth (before the rice flowers), the rice straw is collected by local facilities, dried, and then provided to artisans. This straw, once dried, retains a green color, is durable, and has a distinctive aroma of eight-grain rice. The craft products are exported to Japan. The facility collaborates with local farmers who cultivate 150 hectares of rice specifically for supplying raw materials. After harvest, the rice is brought to the drying workshop and then provided to local artisans who weave and braid it according to the specifications of the buyers. On average, the facility exports 9-10 containers of products each year,

featuring dozens of different designs, generating revenue of 12-13 billion VND.

- **Project "Sustainable Combination between Local Agriculture and Biomass Processing Technology"**: This project is carried out by the Polytechnic University of Ho Chi Minh City in collaboration with Tokyo University, Japan. The project started in 2009, with approximately USD 5 million funded by Japan. This funding comes from two sources: the Japan Science and Technology Agency (JST), which provides direct funding to Tokyo University, and the Japan International Cooperation Agency (JICA), which funds the Vietnamese side. A team of scientists from the Vietnam Oil and Gas Institute and the Polytechnic University of Ho Chi Minh City presented at the Oil and Gas Science and Technology Conference, concluding that with the efficiency of liquid bio-oil recovery, the straw from Vietnam's agricultural production could produce 31 million tons of bio-oil per year. This bio-oil could serve as an alternative fuel and could potentially be upgraded to produce gasoline and diesel in the coming time. However, the project has been successful in the laboratory but remains challenging to implement in practice.

4. Several donors/projects involving in straw treatment models or related to straw recycling

- From 2016 to now, the International Rice Research Institute (IRRI) has coordinated with the Department of Crop Production, domestic and foreign partners to develop techniques and technologies for using and processing rice straw in the direction of circular agriculture, reducing greenhouse gas emissions such as mechanization of

straw collection, mushroom cultivation, making animal feed, biofertilizer, bioplastic, etc.

- Project: Promoting the innovative value chain of straw sponsored by GIZ, project code: GA 1265551 – IRRI
- Circular agriculture economy from straw funded by Mekong-Korea Cooperation Fund (MKCF), code MKCF – 1033639959 IRRI
- One CGIAR Initiative on Asian Mega-Deltas: development of solutions and techniques for circular straw treatment.
- Plan 2021: An effective livelihood model for women and girls is implemented by the Women's Union of Su Phi district, Ha Giang province in collaboration with Plan. The model is organized by Plan to support the remodeling of factory facilities and initial materials with a value of nearly 200 million VND.