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SOLUTIONS TO PROMOTE GREEN CONSUMER BEHAVIOR: A CASE STUDY OF BAGASSE BASED BIOPRODUCTS IN THE CIRCULAR ECONOMY MODEL IN VIETNAM

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Abstract

This study examines green consumer behavior in Vietnam, focusing on bagasse-based bioproducts - a category of products gaining increasing popularity but still facing barriers such as high costs and limited market penetration. The research indicates that short-term solutions (raising awareness, economic support, and information transparency) combined with long-term strategies (developing a circular economy model for the sugarcane industry) play a crucial role in fostering this behavior. The coordinated implementation of these measures not only encourages green consumption to become mainstream behavior but also contributes to shaping a circular and sustainable economy in Vietnam.

Keywords:

Consumer behavior, green consumer behavior, bioproducts, bagasse, circular economy, Vietnam.

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1. Introduction

Plastic waste pollution has become one of the most pressing global challenges, and Vietnam is no exception. According to the Ministry of Natural Resources and Environment, Vietnam generates about 1.8 million tons of plastic waste annually, of which 0.28–0.73 million tons are discharged into the sea. However, only 27% is recycled or reused by enterprises. Waste treatment remains limited, with about 90% of plastic waste handled by burial and incineration, while only 10% is recycled (Manh Hung, 2022).

Meanwhile, Vietnam produces approximately 15 million tons of crushed sugarcane annually. Bagasse accounts for 25–30% of sugarcane weight, equivalent to about 3.7–4.5 million tons per year. Daily bagasse waste is estimated at 10,000–12,300 tons (Viet Thong, 2025). With a cellulose content of 45–55%, bagasse is an excellent raw material for making paper and packaging products, replacing natural wood and reducing deforestation. The short cultivation cycle of sugarcane (12–18 months) makes it a more sustainable and stable resource compared to traditional timber. In Vietnam, new initiatives have explored bagasse applications in producing composites, biodegradable bioplastics, and eco-friendly materials (Nguyen Thi Trang, 2023). From bagasse, manufacturers can produce high-quality office paper, newspapers, food containers, disposable plates and cups, bagasse straws, egg trays, and various food packaging products. These products are not only high quality but also fully biodegradable, meeting the growing demand for green consumption (Viet Thong, 2025).

Research and development of bagasse-based bioproducts are urgent from environmental, economic, and social perspectives. Plastic waste poses a severe global challenge due to its long decomposition time and risk of entering the food chain, threatening both human health and ecosystems. In Vietnam, millions of tons of plastic waste are generated each year, while recycling rates remain low, putting pressure on the environment and waste management systems. Thus, replacing single-use plastics with eco-friendly bioproducts is increasingly critical.

At the same time, Vietnam's sugarcane industry produces large amounts of bagasse - a by-product that is still primarily used for low-value purposes such as fuel, cattle feed, or discarded, without unlocking its full added value. In the context of a growing emphasis on the circular economy, transforming bagasse into bioproducts such as packaging, cups, and biodegradable straws not only helps reduce plastic waste but also enhances the sugarcane industry's value chain.

Recognizing this importance, the research team selected the study ***"Solutions to Promote Green Consumer Behavior: A Case Study of Bagasse-Based Bioproducts in the Circular Economy Model in Vietnam".*** The study aims to identify consumer trends in bagasse-based bioproducts and propose solutions to encourage green consumer behavior within the framework of a circular economy. Using qualitative research methods, the study addresses two key questions: (1) What factors influence the trend of purchasing and using

bagasse-based products? (2) How can consumer perceptions of bagasse-based bioproducts be transformed?

2. Theoretical Framework and Overview of Bagasse-Based Bioproducts in the Vietnamese Market

2.1. Theoretical Framework

Concept of Green Consumption

Green consumption is a component of sustainable consumption, with a primary emphasis on environmental factors. It refers to purchasing environmentally friendly products and avoiding those harmful to the environment (Chan, R.Y.K., 2001). Green consumption expresses responsibility toward environmental protection through choosing eco-friendly products, as well as proper consumption and waste management practices (Hoang Trong Hung, Huynh Thi Thu Quyen, Huynh Thi Nhi, 2018).

It is defined as the consumption of products that do not harm or minimally impact the environment (Halpenny, 2006), or as a process of consuming products beneficial to the environment (Mostafa, 2007). Green consumption is understood as consumers' efforts to minimize environmental damage during purchasing, usage, and disposal, while still meeting consumption needs and maintaining quality of life (Raukoff & Wu, 2013). According to Chen et al. (2010), green consumption is part of sustainable consumption, wherein consumers are aware of environmental issues and assume responsibility when purchasing and using products (Nguyen Thi Hanh, 2024).

Chen and Chang (2012) further explain that green consumption involves social behaviors such as buying bioproducts, recycling, reusing, reducing waste, and using eco-friendly transportation. It encompasses the consumption of products that are preservable, environmentally beneficial, and aligned with environmental concerns. These products facilitate long-term environmental protection and conservation. Green consumption not only implies refraining from using harmful goods but also deliberately choosing eco-friendly and recycled products (Lee, 2010).

Circular Economy

The circular economy is a restorative and regenerative system by design. It replaces the concept of a material's "end-of-life" with the concept of restoration, shifts toward renewable energy use, eliminates toxic chemicals that hinder reuse, and aims to minimize waste through material, product, technical, and business model redesign (Ellen MacArthur Foundation, 2012).

In a narrow sense, the circular economy differs from the traditional linear economy in two main aspects: slowing and closing material loops. Slowing occurs through designing durable products and extending product lifespans (repair, reuse), thereby prolonging utility and slowing material flows. Closing occurs when post-consumption products re-enter

production cycles, creating a closed material loop where waste becomes a resource. Thus, in its narrow definition, the circular economy focuses on the technical cycle of materials (Nguyen Van Lanh, 2022).

In a broader sense, the circular economy is an economic model in which every process (planning, resource allocation, procurement, production, and re-production) and output must be designed and managed to maximize system efficiency and social welfare. Hence, it emphasizes sustainable development and considers economic, social, and environmental impacts of each strategy (Nguyen Van Lanh, 2022).

Green Products and Bioproducts

A green product is one that does not pollute the earth or deplete natural resources and is recyclable and conservable. It is made of materials or packaging that are environmentally friendlier in terms of reducing ecological impact (Shamdasani, Chon-Lin & Richmond, 1993).

Green products use recyclable materials, minimize waste, reduce water and energy consumption, minimize packaging, and release fewer toxins into the environment (Nimse et al., 2007). They combine recycling strategies such as content reuse, reduced packaging, or less toxic materials to minimize environmental impacts (Irawan & Darmayanti, 2012).

Bioproducts are manufactured from biological resources such as crops, animals, microorganisms, and other renewable materials. They are created through biological or modern biotechnological processes to reduce negative environmental impacts (Nguyen Van Thoi, 2025).

According to the FDA, bioproducts are produced from biological raw materials such as fruits, crops, animals, microorganisms, and other renewable resources. These products, generated via biological or advanced biotechnological processes, help reduce environmental impacts and dependence on non-renewable resources (Vietnam Zero Waste, 2021).

Bioproducts offer advantages in terms of eco-friendliness and safety but face limitations such as high costs and relatively low efficiency. Their use must be carefully evaluated to ensure sustainability and practicality in production and consumption. Beyond bioproducts, bio-agents are also favored by many enterprises due to their eco-friendly characteristics when used properly (Vietnam Zero Waste, 2021).

2.2. Overview of Bagasse-Based Bioproducts in the Vietnamese Market

Characteristics of Bagasse-Based Bioproducts

Dried bagasse consists of 45% cellulose, 28% hemicellulose, 20% lignin, 5% sugars, 1% minerals, and 2% ash. Its composition is similar to wood, except for its higher moisture content. Today, bagasse is being utilized as a bio-based raw material for producing eco-friendly products that decompose well after disposal (Anh Ha, 2023).

Common bagasse-based bioproducts include:

- Bagasse straws
- Bagasse food containers
- Bagasse-based cutlery (spoons, forks, knives)
- Bagasse bowls
- Bagasse cup holders

Advantages of Bagasse-Based Bioproducts

- **Low carbon footprint.** Bagasse products are plant-based raw materials with near-zero carbon emissions. Processing occurs at temperatures of up to 160℃ (200℃ for plastics), without heavy machinery or chemical agents. As an environmentally conscious producer, Renouvo uses recycled cooling water in manufacturing, further reducing water consumption while ensuring that raw materials and production processes yield low carbon emissions (Renouvo, n.d.).
- **Biodegradability and compostability.** Bagasse products can biodegrade and decompose naturally by microorganisms at room temperature (20±5°C). The resulting substance can serve as superior carbon-rich compost, enriching soil nutrients (Renouvo, n.d.).

Role of Bioproducts in the Circular Economy

Within a circular economy, green products are central to realizing sustainable development goals. They are not only consumer goods but also "tools" for advancing the circular economy model, in which resources are kept in production – consumption cycles for as long as possible. Fundamentally, green products must meet three criteria: emission reduction, improved resource efficiency, and ecosystem safety (Pham Ngoc Hue, 2024).

In Vietnam, green products increasingly play a pioneering role in the transition to a circular economy, especially in agriculture and rural livelihoods. Furthermore, green products provide Vietnam with a competitive advantage in global integration, as new-generation free trade agreements impose strict environmental standards. Hence, green products are not only a responsible consumption choice but also a structural solution for institutionalizing the circular economy, contributing to the nation's sustainable development goals (Pham Ngoc Hue, 2024).

3. Research Methodology

To conduct the study *"Solutions to Promote Green Consumer Behavior: A Case Study of Bagasse-Based Bioproducts in the Circular Economy Model in Vietnam"*, the research team employed two main methods: desk research (reviewing published documents and media sources) and sociological survey (collecting responses from targeted participants). Data were aggregated and analyzed using Excel software.

Through desk research, the team examined documents on bagasse-based bioproducts, related articles, and reports on the overall sugarcane industry and its by-products (particularly bagasse), as published in various media. Based on this, a questionnaire was designed to conduct a sociological survey on consumer trends regarding bagasse-based bioproducts in Vietnam.

In terms of sociological survey, the research team carried out a preliminary investigation by discussing with individuals interested in or currently using bagasse-based bioproducts. Participants were encouraged to freely share their opinions on various aspects of such products. The preliminary sample consisted of 10 people. The findings from this pilot study were then used to refine the questionnaire. Once finalized, the survey was distributed via Google Form (https://forms.gle/g2SXu3RvWKSgJpW9A) along with direct in-person surveys targeting Vietnamese consumers.

The sampling method combined convenience sampling and the snowball technique (whereby subsequent participants are recruited based on recommendations from prior respondents) to ensure sufficient sample size. A total of 202 valid responses were collected, including: 176 respondents who had used or were currently using bagasse-based bioproducts, 24 respondents who had never used them but expressed an intention to use in the future, and only 2 respondents who stated they had no intention of using them in the future.

4. Trends in the Use of Bagasse-Based Bioproducts

4.1. Descriptive Statistics of Survey Respondents

Table 1. Descriptive Statistics of Survey Respondents

Gender	Number of people	Percentage (%)
Male	80	60.4 %
Female	122	39.6 %
Age		
Under 22 years old	76	37.6%
From 22 to under 30 years old	90	44.6%
From 31 to under 40 years old	24	11.9%
From 41 to under 50 years old	12	5.9%
From 50 years old and above	0	0%
Living area		
North	146	72.3%
Central	38	18.8%
South	18	8.9%
Education level		
High school	40	19.8%
College/Vocational	58	28.7%
University	80	39.6%
Postgraduate	24	11.9%
Monthly income		

Under 1 million	42	20.8%
From 1 to under 5 million	78	38.6%
From 5 to under 10 million	34	16.8%
From 10 to under 20 million	30	14.9%
From 20 to under 30 million	4	2%
From 30 to under 40 million	2	1%
From 40 to under 50 million	6	3%
Over 50 million	6	3%

Source: Survey results

Among the 202 participants, 122 were female (60.4%) and 80 were male (39.6%). Regarding education, 40 (19.8%) were in high school, 58 (28.7%) in vocational/college programs, 80 (39.6%) at university level, and 24 (11.9%) postgraduate.

In terms of living area, 146 respondents resided in the North (72.3%), 38 in the Central region (18.8%), and 18 in the South (8.9%), indicating that the majority of respondents were from Northern Vietnam.

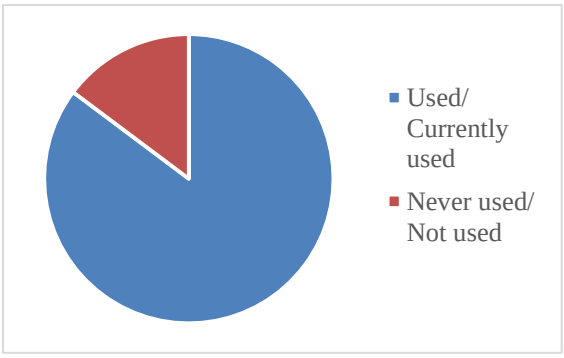
In terms of ages, 76 respondents (37.6%) were under 22, while 90 (44.6%) were aged 22–30. The remaining groups (31–40 and 41–50) accounted for smaller shares at 11.9% and 5.9% respectively. None were over 50. Thus, most respondents were young consumers, mainly under 30.

Regarding income, 42 respondents (20.8%) earned under 1 million VND per month, and 78 (38.6%) earned between 1–5 million, making this the largest group. The 5–10 million group comprised 34 respondents (16.8%), and 30 (14.9%) were in the 10–20 million range. Higher-income groups (20–30, 30–40, 40–50, and 50+ million) represented only small shares (2%, 1%, 3%, and 3% respectively).

4.2. Usage Trends of Bagasse-Based Bioproducts: Survey Findings

Of the 202 participants, 176 had heard of bagasse-based bioproducts, while 26 had not. This suggests that such products are already reaching a substantial segment of consumers. Among the 26 unaware respondents, 24 (92.3%) expressed interest in learning more, whereas only 2 (7.7%) showed no interest. This indicates that green consumption and eco-friendly bioproducts are gaining traction, pushing consumers toward behavioral change in the future.

Figure 1. Recognition of biological products from sugarcane bagasse

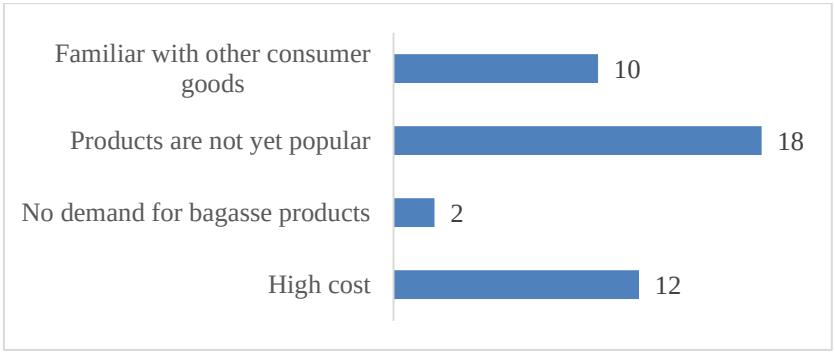


Source: Survey results

Among the 176 who were aware of bagasse-based products, 150 (85.2%) had used or were using them, while 26 (14.8%) had not. The main reasons for non-usage were:

- Limited availability/popularity (69.2%)
- High cost (46.2%)
- Old consumption habits (38.5%)
- No demand (7.7%)

Figure 2. Reasons for not/never using biological products from sugarcane bagasse



Source: Survey results

Among the 26 non-users, most expressed a positive outlook: 53.8% said they *might* use them in the future, and 15.4% said they *definitely would*. Only 7.7% indicated reluctance. This shows strong potential for market growth.

Table 2. Acceptance level of bagasse products in the future

Response Level	Converted to Likert	Number of respondents
Definitely buy/ use	5	4
Probably buy/ use	4	14
Neutral	3	6
Probably not buy/ use	2	2
Definitely not buy/ use	1	0

Average likert score 5/ threshold	3.77 (Might buy/ use)

Source: Calculated from survey results

Among the 150 current/past users, attitudes were largely positive: nearly 85% indicated they would continue or increase use in the future, with no negative responses, and only 16% remaining neutral.

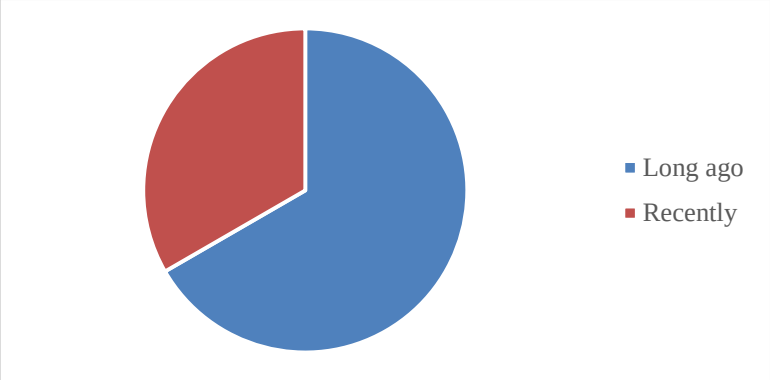
Table 3. Acceptance level of bagasse products in the future

Response Level	Converted to Likert	Number of respondents
Definitely buy/ use	5	52
Probably buy/ use	4	74
Neutral	3	24
Probably not buy/ use	2	0
Definitely not buy/ use	1	0
Average likert score 5/ threshold	4,19 (Might buy/ use)	

Source: Calculated from survey results

In terms of timing, among the 150 users, 100 (66.7%) had been aware of these products for a long time, while 50 (33.3%) had only recently encountered them. This reflects their growing familiarity, especially in the context of Vietnam's green transition.

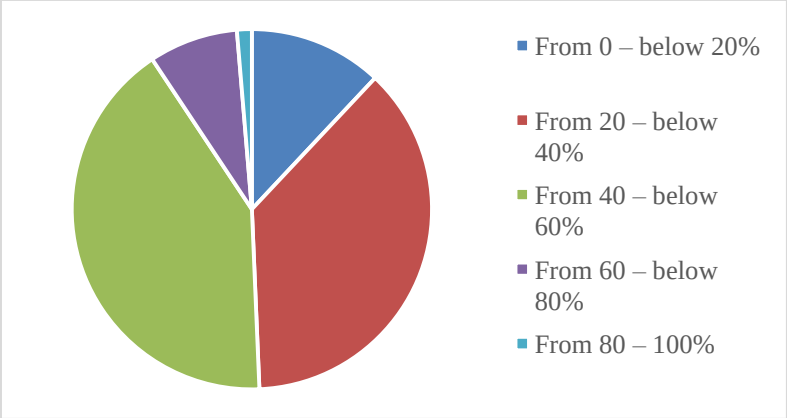
Figure 3. Time to access products from bagasse



Source: Survey results

Survey data also revealed that most consumers (about 79%) used eco-friendly products at a rate of 20–60% of their consumption. However, high-usage groups (above 60%) were still limited (<10%).

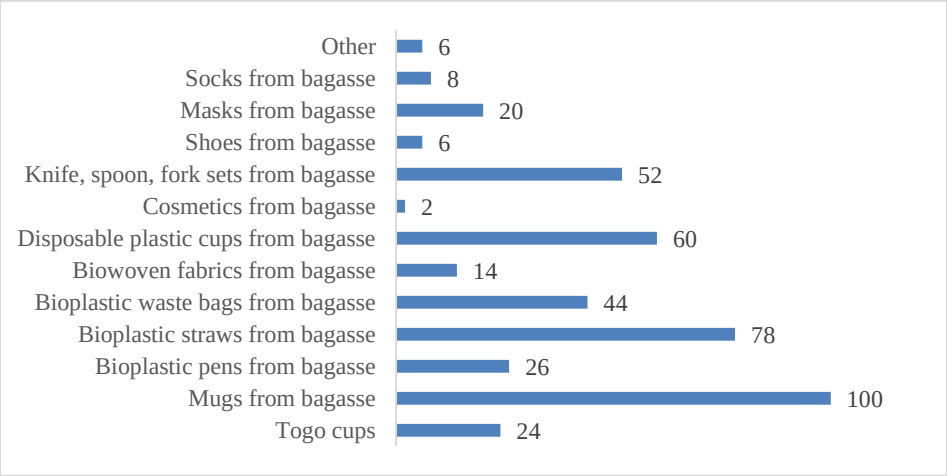
Figure 4. Environmental friendliness of bio-products from bagasse



Source: Survey results

When surveyed about bio-products from sugarcane bagasse, the most used product groups are familiar items in daily life such as cups made from sugarcane bagasse (66.7%), bio-straws (52%), disposable plastic cups (40%) and knife, spoon and fork sets made from sugarcane bagasse (34.7%). Some products with average usage levels include: bio-waste bags (29.3%), bio-plastic ballpoint pens (17.3%), togo cups (16%), and masks made from sugarcane bagasse (13.3%). Finally, the products that are rarely used include textiles (9.3%), shoes (4%), socks (5.3%), and some other products that only account for 1.3%.

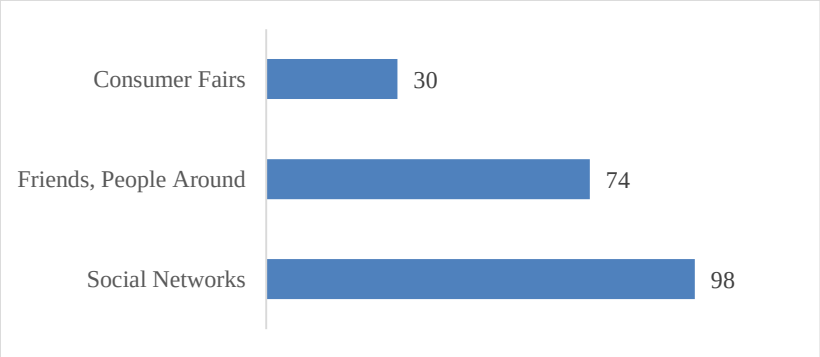
Figure 5. Biological products from bagasse



Source: Survey results

The consumer survey results from Figure 6 show that the majority learned about biological products from bagasse through social networks (98 people, accounting for 65.3%), 74 people learned about the products through friends and people around them (accounting for 49.3%) and 30 people (accounting for 20%) learned about the products through consumer fairs. It can be seen that along with the green transformation process, digital transformation activities, the development of media and social networks help consumers easily access knowledge and information about biological products from bagasse.

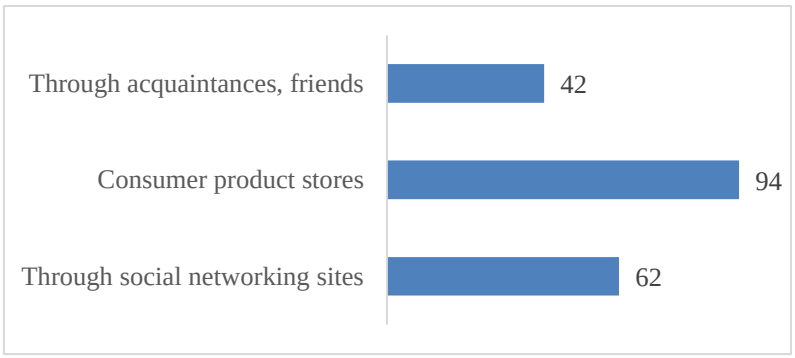
Figure 6. Means of studying biological products from sugarcane bagasse



Source: Survey results

Regarding the place to buy biological products from sugarcane bagasse, 62 people bought the products through social networking sites (41.3%), 94 people (62.7%) bought at consumer product stores and 42 people through acquaintances and friends (28%). Thus, the majority of the survey subjects still trust and choose consumer product stores as the optimal choice. On the other hand, social networking sites are also suitable places to buy for consumers, especially young people today.

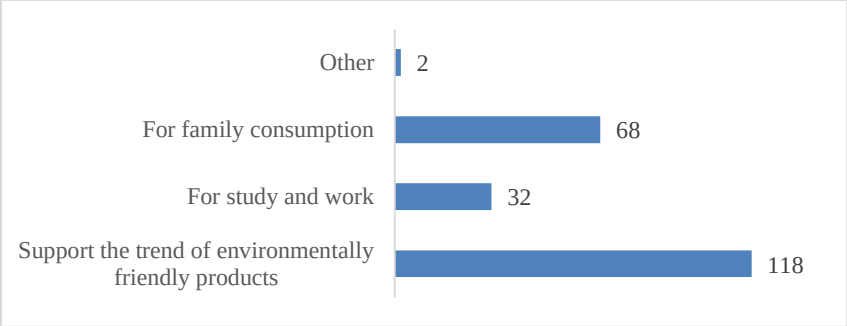
Figure 7. Where to buy biological products from bagasse



Source: Survey results

Among 150 people who have used/are using biological products from sugarcane bagasse, the majority of survey participants use products from sugarcane bagasse to support the trend of environmentally friendly products (78.7%), 32 people (21.3%) buy them for study and work purposes and 68 people use them for family consumption (45.3%). It can be seen that the level of social influence plays an important role in promoting consumers to use biological products from sugarcane bagasse.

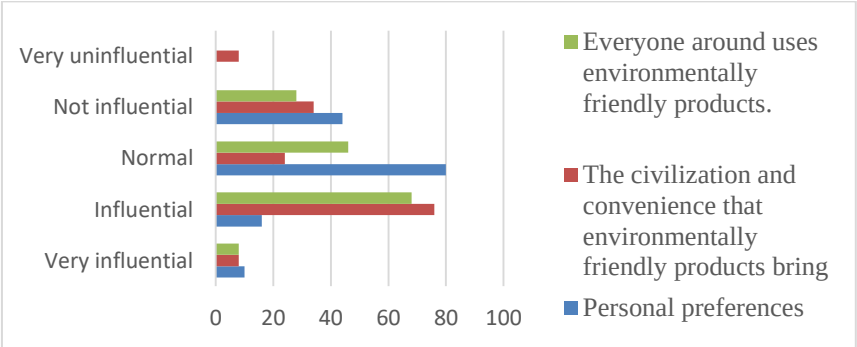
Figure 8. Purpose of using biological products from bagasse



Source: Survey results

With 3 factors "Personal preference", "Civilization and convenience that environmentally friendly products bring" and "Everyone around uses environmentally friendly products" determined by 5 levels: "Very influential", "Influential", "Normal", "Not influential", "Very not influential". Survey data shows that the factor "personal preference" is not the decisive factor, when the majority of participants (80 votes) chose the level "Normal" and the average value was only 2.95. On the contrary, the factor "civilization and convenience that products bring" was rated higher, with 76 votes choosing the level "Influential" with an average value of 3.28 but only at the threshold of "Normal". Finally, the factor "influence from people around" has the strongest impact: 68 votes at the level of "Influence", 8 votes "Very influential" with an average value of 3.37 – the highest of the three factors.

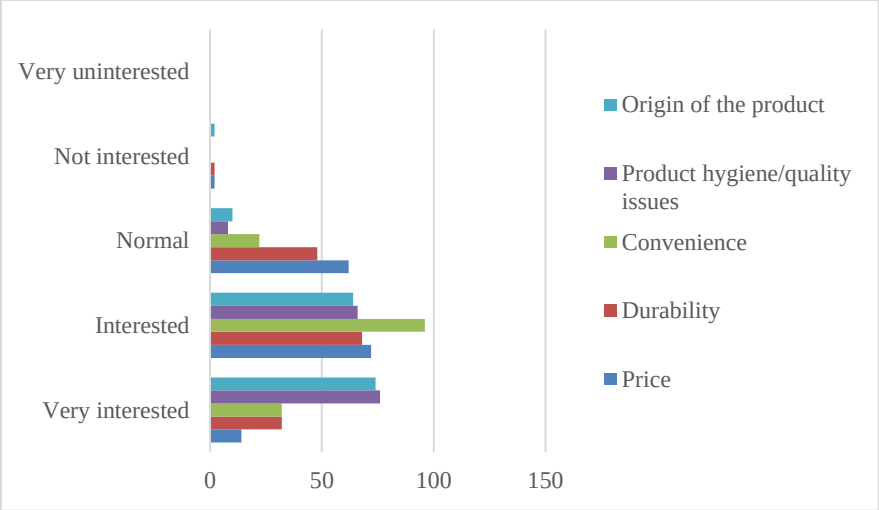
Figure 9. Factors influencing the trend of using biological products from bagasse



Source: Survey results

With 5 factors "Price", "Durability", "Convenience", "Product hygiene/quality", "Product origin" determined by 5 levels "Very interested", "Interested", "Normal", "Not interested", "Very uninterested". Survey data shows that "product hygiene/quality" and "Product origin" are the most interested factors with 76 votes "Very interested", 66 votes "Interested" and 74 votes "Very interested", 64 votes "Interested", respectively, all reaching an average value of over 4.4. Convenience and durability are also highly appreciated with the threshold of "Interested". Although price is still noticed (average 3.65), it is lower than other factors.

Figure 10. Aspects influencing interest in environmentally friendly products



Source: Survey results

5. Solutions to Promote Consumer Adoption of Bagasse-Based Bioproducts

5.1. Short-Term Solutions

Based on the findings on consumer trends toward bagasse-based bioproducts, the research team proposes several short-term solutions to stimulate greater adoption in the future:

First, raise consumer awareness through effective communication campaigns. Strong and creative media campaigns are needed to emphasize the environmental benefits of bagasse-based products. Bagasse is a renewable raw material, biodegradable, and non-polluting. Campaigns should be delivered across multiple platforms, especially social media. Partnerships with brands, KOLs, KOCs, experts, and schools can help integrate product knowledge into workshops, fostering a generation of environmentally conscious consumers who embrace green consumption habits.

Second, implement economic support policies for the sugarcane and bagasse-based product industries. High product prices remain a key barrier. The government could apply subsidies to make bagasse-based products more competitive with conventional plastics. Tax exemptions or reductions for producers would encourage investment in technology and scaling. In addition, preferential loans for start-ups in this field could boost innovation and diversify the product market.

Third, develop supply chains and expand market access. A sustainable supply chain should link sugar factories with bioproduct manufacturers to ensure stable inputs and reduced transport costs. Retail chains, supermarkets, and restaurants should be encouraged to replace plastic items with bagasse-based alternatives. The participation of large brands will accelerate consumer acceptance. Moreover, diversifying the product range - from cups and food containers to paper and building materials - will broaden the market and meet varied consumer needs.

Fourth, ensure transparency in production processes. Consumers today demand clarity about product origin and quality. Obtaining reputable environmental certifications (e.g., biodegradability, FSC for plant-based products) builds trust. Clear green labels on packaging make products easily recognizable. Transparent production - from raw inputs to final goods - will further strengthen consumer confidence and purchase decisions.

Fifth, promote partnerships with green events. Collaborating with eco-friendly festivals, fairs, and communities is an excellent way to reach target consumers. By replacing single-use plastics with bagasse products at events, organizers not only reduce waste but also project a positive environmental image. Product booths and on-site experiences allow consumers to appreciate quality and usability firsthand.

Box 1. Examples of Green Consumption Promotion Initiatives in Vietnam

The government and organizations in Vietnam have been introducing various initiatives to promote green consumption and bagasse-based bioproducts. Supporting green start-up competitions and student entrepreneurship programs with social impact has been particularly effective.

Such programs - often hosted by major universities with support from organizations, funds, and enterprises - create testing grounds for sustainable business ideas and encourage students to research and apply eco-friendly solutions. These competitions attract hundreds to thousands of participants annually, equipping them with knowledge, seed funding, and expert networks. Widespread implementation of these initiatives develops a workforce of environmentally conscious young professionals and raises community awareness of replacing plastics with bioproducts, thereby strengthening the circular economy model.

A notable example is Vietnam Social Challenger Sunny 2022, hosted at the National Economics University with sponsorship from the Institute for Innovation and Development (IID), The Happiness Foundation, and SK Group Korea. The program drew over 1,000 teams focused on addressing social and environmental issues through sustainable business models. Several projects utilized agricultural by-products such as pineapple leaf fibers - for instance, Team ECOPINA from Vinh University, which made it into the program's Top 7 finalists.

Source: Compiled by authors

5.2. Proposed Circular Economy Model for the Sugarcane Industry

A circular economy model is proposed for the sugarcane industry to optimize resource use, minimize waste, and transform the traditional linear model (produce–consume–discard) into a closed, sustainable cycle. The core idea is to turn bagasse waste into high-value products, thereby creating a new value chain.

The model can be summarized in three stages:

1. *Primary production:* Sugarcane is harvested, pressed, and processed into sugar and syrup.

2. *Bagasse reuse*: Remaining bagasse becomes input for other production processes.
3. *Recovery and recycling:* By-products such as cane sludge and wastewater are treated and reused.

Utilization cycle of bagasse: Instead of being used only as boiler fuel, bagasse can be processed using advanced technologies to produce higher-value goods:

- *Bioproduct manufacturing:* Bagasse is processed to extract cellulose for bio-pulp production. This serves as the raw material for disposable, eco-friendly products such as cups, straws, food containers, and egg trays—all fully biodegradable and alternatives to plastic waste.
- *Construction materials and energy:* Excess bagasse can be compressed into particle boards, insulation materials, or converted into biomass fuel for powering sugar factories themselves, thereby reducing fossil fuel dependence and lowering production costs.

Effectiveness and sustainability of the model:

- ***Economic:*** Generates additional revenue from waste, reduces waste-treatment and energy costs.
- ***Environmental:*** Cuts waste, soil and water pollution, and greenhouse gas emissions by reusing bagasse as biofuel.
- ***Social:*** Supports the development of a green economy, creates jobs in environmental technology, and enhances community awareness of sustainable consumption.

Conclusion

The research findings show that green consumer behavior, particularly the adoption of bagasse-based bioproducts, is on the rise in Vietnam. However, barriers such as high costs and limited availability still remain. To further stimulate this behavior, both short-term and long-term measures must be implemented in tandem. Short-term strategies should focus on raising public awareness through multi-channel communications, introducing economic support policies to reduce product prices, and ensuring product origin transparency to build trust. Most importantly, the development of a circular economy model for the sugarcane industry represents a strategic solution. This model not only transforms bagasse into a valuable resource for eco-friendly products but also optimizes production processes, creating sustainable economic, environmental, and social benefits. In summary, the coordinated application of these solutions will create a powerful momentum to turn green consumption from a trend into a mainstream behavior, thereby contributing to the establishment of a sustainable economy in Vietnam.

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