

Development of A Sustainable Consumption Model of Corn Plant Through A Circular Economic Approach (Case study of the processing program of corn stalks into alternative fuel to replace coal for CSR SIG Tuban Factory)

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ABSTRACT

In Tuban, farmers have great potential to manage corn cob waste into alternative fuels, but there is still a lack of experience and awareness of waste management. This research aims to develop an educational model that can increase the utilization of waste. The method used is Design-Based Research (DBR) with a qualitative approach, including problem identification, needs analysis, model development, and model testing through workshops. The survey results show that most farmers have not managed corn cob waste properly. The workshop succeeded in increasing farmers' knowledge about waste management and producing alternative fuel products. The educational model developed is effective in increasing farmers' awareness and skills in waste management. In conclusion, this sustainable consumption education model is effective in increasing the use of corn cob waste as an alternative fuel. For long-term success, it is necessary to pay attention to the aspects of technology, flexibility of participation, and freedom of expression in the Generation Z farming community.

Keywords : Circular Economy, Corn Cob, Alternative Fuels, Agricultural Waste Management, CSR

INTRODUCTION

Development is a process of improving quality and capability, development is also needed in the economic sector. The problems of poverty, welfare and unemployment encourage the formation of economic development to increase income and accelerate the rate of economic growth from the regional level to the national level. The acceleration of economic growth has always been identified with industrialization which is the prima donna for developing countries. The demands of the times to improve living standards are also felt in Indonesia. The emergence of industrialization variables as a form of business that can improve the quality of human resources, optimal use of natural resources as well as a marker of the rise of technological progress. For developing countries, industrial development is basically like a change from a traditional country to a modern country or as a transition from an agrarian society to an industrial society. The consequences of the change have an impact on people's lives both economically and socially. The presence of industry also results in changes in the physical appearance of the region in addition to having an impact on environmental damage. Industrialization in various countries is believed to be a remedy to overcome problems such as increasing state income, reducing unemployment, expanding the economic activities of the population, and even eliminating the gap between developed and developing countries as superior and minority.

Indonesia as a country that has succeeded in changing the structure of the agrarian economy into industry is almost 80% spread on the island of Java, and makes Java the center of industry in Indonesia. Areas that have the potential to develop an industrial

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economy will attract investors to explore and exploit the areas used to develop their businesses. Especially if the area is in a strategic area, easy access to land, licensing, port availability, availability of industrial estates and various other industrial development supports.

The Sustainable Development Goals (SDGs) or Sustainable Development Goals (SDGs) are an agreement of global leaders to change development procedures in each country towards sustainable development that focuses on poverty eradication, social inequality reduction, and environmental protection. The SDGs are a follow-up to the Millennium Development Goals (MDGs) which ended in 2015. The SDGs, or hereinafter referred to as SDGs, consist of 17 goals and 169 targets that are expected to be achieved by 2030 (Bennich, Weitz, & Carlsen, 2020).

In Indonesia, the commitment to the achievement of SDGs is manifested in Presidential Regulation No. 59 of 2017 concerning the implementation of the achievement of sustainable development goals. The Presidential Regulation contains a national roadmap for the SDGs in the form of the government's strategic policy stages until 2030. In this Presidential Regulation, it is stated that the achievement of the SDGs is not only the responsibility of the central government, but also local governments, community organizations, academics, philanthropy, and business actors. However, the emergence of this Presidential Regulation does not guarantee that the strategic plan that has been prepared in such a way can be achieved easily. This is illustrated by Indonesia's ranking position in the achievement of SDGs, which in 2022 was ranked 82nd out of 163 countries with an achievement score of 69.16 out of a maximum score of 100 points (Sustainable Development Report, 2018).

The objectives of the SDGs are, among others: (1) to eliminate poverty, (2) to end hunger, (3) good health and welfare, (4) quality education, (5) gender equality, (6) access to clean water and sanitation, (7) clean energy and access, (8) decent work and economic growth, (9) infrastructure, industry and innovation; (10) reducing inequality; (11) sustainable cities and communities; (12) responsible consumption and production; (13) handling climate change);

(14) maintaining marine ecosystems; (15) maintaining terrestrial ecosystems; (16) peace, justice and strong institutions; and (17) partnerships to achieve the goals (official website of the Department of Economic and Social Affairs Sustainable Development UN, 2022). The latest data from the Sustainable Development Report (2018) shows that, out of 17 SDGs in Indonesia, only 4 targets show achievement according to the specified targets, namely: quality of education, access to clean water and sanitation, decent work and economic growth and responsible consumption and production.

Tuban in 2017 was appointed as a National Food Barn in the form of corn food crops. With the existence of a large area or agricultural land, it is a potential that needs to be developed in terms of agriculture. The area of agricultural land used by farmers in Tuban district to plant corn in 2020 is 128,713 Ha, in 2021 it is 134,215 Ha while in 2022 it is 137,121 (source: Tuban Agriculture and Food Security Office). Looking at the data, it indicates a significant increase related to the expansion of corn plants in Tuban district. The expansion of the land was also followed by an increase in corn yield in Tuban district. From the Agency's sources of information related to the corn harvest in 2020 as much as 726,585 tons, in 2021 it was 758,213 tons, while in 2022 it increased by 774,322 tons. From the abundant corn plants, there are leftover agricultural products which are also a problem in community life. One of the causes of a slum environment, air pollution, and poor drinking water quality is waste management problems. Solid waste that is not

handled properly causes the environment to become slums and the city's air is polluted (Kirani, Rachmasari, Marbun, Ramadhan, & Utomo, 2022).

In general, the composition of organic waste in the form of agricultural residues, especially corn humps from corn agricultural products, is proven to have a larger amount than inorganic waste, which ranges from 60% to 73% of the total waste generation (Arief, 2013; Brigita & Rahardyan, 2013; Khasanah, Rofiah, & Setiyadi, 2019; Widiarti, 2012). Most of the agricultural products left over from the remains of corn plants in the form of corn stumps are just burning garbage. Then a small part is used for the burning needs of tofu production. Several research results try to unravel the causes of slow progress in agricultural waste management activities, including: lack of government awareness in providing facilities for processing agricultural waste specifically (Brigita & Rahardyan, 2013) lack of public awareness and knowledge in sorting waste (Brigita & Rahardyan, 2013; Kurniawan & Santoso, 2020; Yudhistirani, Syaufina, & Mulatsih, 2016) The absence of resources specifically employed to sort waste and the lack of creative communities in waste management.

GIS Tuban Factory is one of the companies in Tuban Regency. In 2017, along with the appointment of Tuban as a national corn food barn, GIS Tuban Factory also supported and implemented by forming a community empowerment program. This community empowerment program covers 26 villages spread across three sub-districts, namely Merakurak, Kerek and Jenu sub-districts. One of the implementations that is encouraged is the community-based MSME program. With the formation of MSME groups, it is hoped that they will be able to boost the community's economy through creative economic activities that are oriented to how MSME groups can take advantage of the potential that exists in Tuban and the potential that exists in their respective villages. From the potential of the village, there is a Popcorn Business program, corn flakes business, animal feed business, and corn rice culinary business. And at the beginning of 2023, MSMEs fostered from the Tuban Factory GIS emerged who dared to take a breakthrough, namely processing agricultural waste into alternative fuels.

In addition to forming the Tuban Factory GIS MSME Group, it also conducts empowerment programs on the lower line, namely farmers in the Tuban Factory GIS development area by forming a farmer group named the Greenbelt farmer group and also a cooperative that houses the *teni* group. The cooperative was then given the name Greenbelt Farmers Cooperative.

Cooperatives were established based on Pancasila and the 1945 Constitution. This means that in running their business, cooperatives must comply with the rules in Pancasila and the '45 Constitution. Cooperatives are run on a familial basis. This means that cooperatives do not aim to benefit only one person, but to achieve mutual benefits. This distinguishes cooperatives from other business entities.

The Indonesian Cement Greenbelt Farmers Cooperative Tuban Factory is a cooperative consisting of greenbelt farmers assisted by PT. Semen Indonesia Tuban factory which was established on July 25, 2019. This cooperative is a type of producer cooperative, aiming to provide agricultural production facilities for greenbelt farmers as well as a provider of farmer capital and post-harvest service providers both for the purchase of crops and the marketing of agricultural products.

In its development, the greenbelt farmer cooperative has business units that have been established since 2020. Some of the business units run include: 1. Saprotan Shop Business located in Sumberarum village, Kerek district; 2. Cavendish banana nursery and reponing in the Kambang semi Ecopark area; 3. Eucalyptus Oil Distillation; 4. Cultivation

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of Tilapia in Floating Net Cages; 5. And the Savings and Loan Business Unit members.

The business unit has been running and contributing profits to the greenbelt farmer cooperative. In the course of the year, maintenance and development of new business units are required for all business units.

In connection with this, innovative agricultural models were formed and realized. In addition, it is also needed to reduce the residual products from agricultural waste. In its development, this corn has been able to develop widely and is expected to be able to develop and can also provide various forms of services about needs. At the same time, it is able to provide the needs needed for household food needs and food needs for livestock businesses and others. With the existence of material waste in the form of corn cobs, the farming community should be able to make good use of it. One of them is how to manage janggal hump waste as an economic source in the community. More specifically, the community around the Indonesian cement factory Tuban factory.

Creative and innovative touches that must be done by farmers are how to unite or collaborate between agriculture and industry. As much as possible, farmers must strive for business forms and what procedures can be done by farmers so that later they can also meet the needs of factories. The products produced can be in the form of alternative fuels from agricultural waste management. This business is expected to be useful for the welfare of business owners and farmers as well as a model for local residents. In addition, with high fighting power that is creative, innovative and useful for the community, it is hoped that it can also open jobs for increasing community independence and welfare. And from this effort, it is hoped that it can be an initial milestone in the empowerment and utilization of agricultural waste as a new alternative fuel with a new renewable Circular Economy approach.

(De la Torre, Onggo, Corlu, Nogal, & Juan, 2021) argue that there are other ways to help transition from a linear economy to a circular economy to a more effective society, namely by promoting the concept of sustainability beyond the formal curriculum, and positioning it as a supporter of business activities. The result of this thinking inspires novelty, namely how it should not only focus on integrating the concept of sustainability into the formal curriculum, but also be able to be a pioneer of this change through a more tangible movement supported by all components such as the company around it.

(Benson, Scales, Hamilton, & Sesma Jr, 2007) in the theory of community context and change stated that there are five strategies that can be carried out to make changes in the community, namely: (1) involving adults, (2) mobilizing farmer activities, (3) activating sectors around the community, (4) strengthening programs, and (5) influencing policy. This theory underlies the development of a community-based sustainable consumption education model that will be designed in this study. The media in the form of a student community was chosen based on considerations that are in accordance with the opinion of (Delgado & Staples, 2007) which states that the younger generation needs to be the main actor in every change, of course with guidance from more mature people. The change intended here is a change in the behavior of the younger generation to become more aware in implementing sustainable consumption practices.

Based on the line of thinking that has been explained, the CSR program of the Tuban Factory GIS seeks to respond by creating social innovations that can integrate MSME groups and Greenbelt farmer cooperatives so that they can be mutually sustainable. Problems with raw materials for MSME production as well as agricultural waste and Kitchen Waste from the production process produced by MSME groups in the factory development area. To realize a waste-aware society, the CSR of the Tuban Factory

GIS has formed a community of young people, MSME groups and farmer groups fostered by the CSR of the Tuban Factory GIS. Which aims to become a waste-aware society whose main activity is by referring to the concept of sustainable consumption, namely reducing excess food consumption and processing leftover agricultural products and leftover MSME production into products of economic value. Therefore, the title raised in this Social Innovation is "Development of a Sustainable Consumption Model of Corn Plants Through a Circular Economy Approach".

RESEARCH METHOD

Research and development of a sustainable consumption education model for corn plants through a circular economy approach with a community approach uses a qualitative approach with the Design-Based Research (DBR) method. DBR is a methodology designed by and for educators that seeks to improve the impact, transfer, and translation of educational research into better practice (Anderson & Shattuck, 2012). In addition, DBR emphasizes the need for the development of theories and the development of design principles that guide, inform, and enhance practice and research in the context of education. Design-based research is not an approach but rather a set of approaches applied with the intention of producing new theories, artifacts, and practices that take into account and potentially influence learning and teaching in a naturalistic setting (Barab & Squire, 2016).

The DBR method was chosen to develop a sustainable consumption model for students because this method is flexible and in accordance with needs so that the designed model has the flexibility to develop according to the conditions found during research and development in the field. The DBR method is expected to be able to create an effective sustainable consumption education model for farmers even though this model is designed in the form of informal learning to provide understanding and knowledge to corn farmers about the benefits of using corn crops.

RESULT AND DISCUSSION

Results of Research and Development Phase 1: Problem Identification and Needs Analysis

The first step in researching and developing a sustainable consumption education model based on the farmer community with the use of corn cob waste as an alternative fuel to replace coal is the process of identifying problems and analyzing farmers' needs. Problem identification is carried out with various approaches. The first approach is to fill out a survey to active farmers in the development area of the Tuban Factory GIS to identify their knowledge about waste management, their perception of waste, and their perception of their environmentally friendly self-identity.

A total of 641 farmers across villages and sub-districts filled out the survey anonymously. The survey was adopted from (Nguyen, Malek, Umberger, & O'Connor, 2022) with some adjustments and has been retested in terms of reliability and validity of its constructs. Descriptive analysis with index numbers is used to explain the survey results. The demographic data of the research can be observed in Table 1.

Table 1 Demographic Data of Research Respondents

Indicators	Answer Options	Total	Percentage
Gender	Woman	485	73,4%
	Man	176	26,6%

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Semester	1	414	64,59%
	3	122	19,03%
	5	74	11,54%
	7	15	2,34%
	More than 7	16	2,50%
Residence	Kos	485	73,4%
	Parents' Home	128	19,4%
	Contract House	40	56,1%
	Private House	8	1,2%
Have experience in processing waste?	Not	450	68,1%
	Yes	211	31,9%
How Handling of corn waste so far?	Put at	350	54,60%
	Unsorted trash can		
	Put in the trash can after sorting	100	15,60%
	Given to animals	26	4,06%
	Put on a composter	11	1,72%
	Other	154	24,02%

Table 1 shows the fact that more than half of the respondent farmers have no experience in managing corn cob waste. However, from 31.9% of farmers who have experience in managing corn cob waste, they have gained interesting experiences with their corn cob waste, such as: processing corn crop waste into compost, utilizing corn cobs as animal feed, processing corn cob waste into animal feed, or simply burning corn cob waste in the backyard (the last two examples are found in further details in miscellaneous points).

As many as 54.60% of farmers revealed that they just throw away garbage without sorting it. This fact requires deeper attention because waste segregation is essential to achieve high rates of reuse and recycling of waste (Stoeva & Alriksson, 2017). In fact, the number of respondents who have sorted waste has reached 100 people, there are even 11 farmers who put their own corn cob waste into the composter. However, this number is still very small compared to the total sample respondents in this study. This shows that the problem of waste sorting still needs more attention in the preparation of the sustainable consumption education model that will be designed. Table 4.2. describing farmers' perceptions of corn cob waste management 3 indicators, namely: (1) personal benefits felt from corn cob waste sorting; (2) discomfort in sorting corn cob waste; and (3) self-identity towards the environment. Farmers' perceptions are measured using index numbers for each indicator.

Table 2. Farmers' Perception of Corn Cob Waste Management

It	Statement	Answer (%)	Frequency	Index	Category			
Personal Benefits of Sorting Food Waste (Cronbach's α =0.89)								
1	Sorting corn cob waste into organic trash is the right thing to do	9,7	15,9	46,3	20,3	7,8	60,12	Keep

2	I feel comfortable sorting and properly disposing of corn cobs where they can be sold	7,3	10,3	33,1	28,9	20,4	68,96	Keep
3	By using an organic bin for corn cobs, my bin remains clean and does not need to be removed frequently.	19,8	28,5	30,3	12,5	8,9	52,44	Low
Discomfort and lack of control in using organic bins (Cronbach's α =0.79)								
4	I don't have enough information about corn cob waste as an alternative fuel	7,6	14,9	35,7	26,8	15	65,34	Keep
5	Equipment for sorting and processing corn cob waste is expensive	10,8	24	39,6	16,9	8,7	57,74	Keep
6	I don't want to deal with with corn cob waste that is unsightly and unsightly	10,5	18,4	33,8	24,8	12,5	62,08	Keep
7	Too many time and attempts to sort corn cobs	8,9	21,4	38,8	22,8	8,1	59,96	Keep
8	I have no control over the corn cobs because other people around are also throwing them away	10,5	17,6	33,7	24	14,2	62,76	Keep
Self-identity over the environment (Cronbach's α =0.89)								
9	Acting eco-friendly is an important part of me	3,4	1,6	3,4	10,5	81,1	92,86	Very High
10	I'm the type of person who acts environmentally friendly	0,8	3,1	32,4	40,6	23,1	76,42	Tall
11	I see myself as an eco-friendly person	1,4	4,1	39,4	35,6	19,5	73,54	Tall

Note: All statements are graded on a 5-point Likert scale; SOD = Processed Kitchen Waste (Adopted from Nguyen et al., 2022)

The results of the survey to farmers listed in Table 4.2 are interesting findings because there is a significant difference between the perception of farmers who feel that they are environmentally friendly individuals (indicators on the variable of self-identity towards the environment show very high and high categories) and the fact that farmers still feel uncomfortable and do not have control over waste sorting activities. and even have low awareness to sort waste, especially corn cobs. This survey confirms the fact that most farmers perceive themselves to be environmentally friendly individuals, but their behavior does not reflect the same thing, especially in terms of sorting corn cob waste.

The type of corn cob waste that farmers throw away every day has a fairly high variety. The results of a survey of 660 farmers showed that the highest variation of corn husks that they threw away every week was corn husks that were still mixed with corn

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husks with a percentage of respondents' answers reaching 57.4%, followed by corn husks that were not mixed with corn husks (49.7%).

Corn husks mixed with corn husks	57,4 %
Corn husks are not mixed with corn husks	49,7 %

Figure 3. Design of a Sustainable Consumption Model Based on Farmer Communities through the Utilization of Corn Cob Waste

Based on the design, the model for the development of sustainable consumption education based on the farmer community through the use of corn cob waste is formulated in the form of the initial framework of the model as can be observed in Figure 1 below.

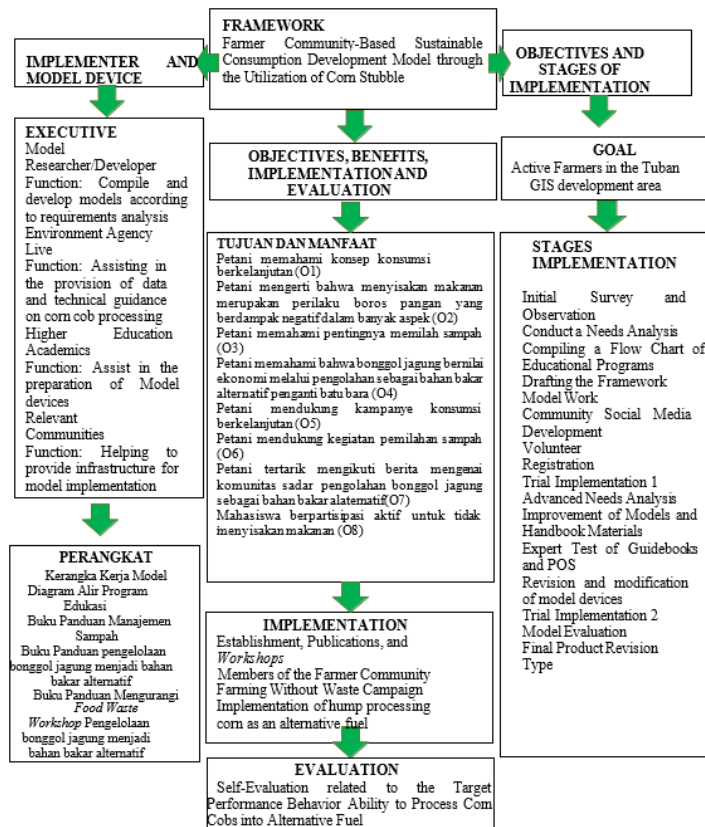


Figure 1 Initial Framework for Farmer Community-Based Sustainable Consumption Model through the Utilization of Corn Cobs as an Alternative Fuel Results of Research and Development Phase 3.1: Model Testing & Evaluation

The third stage of developing a sustainable consumption model for farmers is testing the implementation of the model that has been prepared as well as evaluating the implementation. The prototype testing stage refers to the sequence in the framework of the model that has been created. The identity and social media of the Zero Waste Community (Komunals), which has been created and developed in June-July 2023, will then be used to socialize open recruitment for farmers who want to register as community members. This recruitment is not limited to the requirement that the applicant must be an active farmer, but is open to the general public as widely as possible with the aim of measuring public interest in the existence of this community.

The first workshop of the Komunals was held on June 9, 2023 and was attended by 29 farmers out of 30 workshop registrants. *The workshop* was opened with material on the fact that Indonesia is the highest producer of agricultural waste in Southeast Asia, the importance of managing corn cobs, and the introduction of processing corn cobs into alternative fuels. After that, workshop participants were invited to practice directly sorting corn cobs from agricultural products around the GIS Tuban Factory company, collecting corn cobs, and producing them into fuel alternative. The series of *workshop* activities can be observed in Figure 4.12 to Figure 4.15.

The series of Commune Workshop activities is the beginning of a limited trial of 10 prospective Commune volunteers



CONCLUSION

The research process and development of a community-based sustainable consumption education model for farmers with the use of corn cob waste as an alternative fuel has resulted in findings that can be concluded, namely

Communities that match the character of farmers who are Generation Z need to pay attention to several key aspects. Generation Z, which is a group of people born between 1997 and 2012, has unique traits that influence their preferences and needs within a community. Some of the characteristics that must exist in the community so that it is relevant to farmers are: (1) technology-centric, the community needs to utilize technology and social media as the main means of communication and interaction because Generation Z is more likely to be involved in online communities than physical communities; (2) Flexible, Generation Z wants to have control over when and where to participate in community activities. A community that allows them to join and contribute in a freer way would be more appropriate;

(3) providing freedom of expression and learning, Generation Z tends to be more active in the community which allows them to contribute according to their field of voice and freedom of opinion in every decision-making. Meeting the needs and preferences of Generation Z, the community can be more successful in attracting and retaining its members.

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