Research Article

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Received: 18 August 2023 / Accepted: 25 October 2023 / Published: 5 November 2023

Sustainability: Mechanized Handling of Large-Scale Livestock's Cow Manure Factors Into a Greener Economy

Roong Ratikul*

Somchai Seviset

Songwut Egwutvongsa

School of Industrial Education and Technology,
King Mongkut's Institute of Technology Ladkrabang,
Bangkok, Thailand
**Corresponding Author*

DOI: https://doi.org/10.36941/ajis-2023-0171

Abstract

This research objective is to develop a large-scale livestock cow manure processing machine to add economic value and be environmentally friendly. The population was 4,994 dairy farmers in Nakhonratchasima province, Thailand. The sample group was the dairy farmers group in Pak Chong district Nakhonratchasima province, Thailand, with a total of 357 people. By evaluating the rating scale (Rating Scale) five levels of Likert. and there was a confidence value with an alpha coefficient (Cronbach's Alpha = 0.703), which was analyzed by SLR systematic literature review and scamper analysis by synthesizing the data to design new products as three main issues were 1) product creation guidelines from SLR literature review 2) problem diagnosis to the solution with SCAMPER technique 3) new product design in accordance with GOAL data were analyzed by multiple regression analysis and confirmatory factor analysis which found that 1) factors machine features 2) the efficiency factor of the machine and 3) image factors of the machine that resulted positively on farmer satisfaction and explained the farmer satisfaction variance of 71.9%. The standard score regression equation was $Z = .453(X_1) + .384(X_2) + .465(X_3)$ *and the regression equation in raw score* $\hat{y} = -1.20 + .460(X_1) + .385(X_2) + .466(X_3)$*. When evaluated with CFA, the satisfaction of the sample group of dairy farmers group with the developed cow dung separate machine was found. That is the result of 3 factors according to the model concordance index:* $\chi^2 = .874$*,* $df = 4$*, relative* $\chi^2 = .219$*, p-value = .928, RMSEA = .000, RMR = .004, GFI = .996, AGFI = .956, NFI = .998, TLI = 1.078, PGFI = .089, RFI = .980, AIC = 82.874*

Keywords: *sustainable development, sustainable communities, greenhouse gases, cow manure, cow manure separate machine*

1. Introduction

Since the event in which Brazil's Amazon, the world's largest forest, has been trespassed and long 100-year-old trees have been used for income generation. There is also encroachment to use the Amazon Forest for livestock and monoculture farming. This affects the current global warming situation that is intensifying even more severely When this news has spread to the impact, it has become aware of environmental problems that all people around the world need to pay attention to

and pay attention to environmental problems that can affect their way of life. be human beings in the future. Nowadays, the environment has been compromised and large grazing areas have been taken up, and this is also an area that is contributing to the continual increase in carbon dioxide emissions into the Earth's atmosphere. Even resulting in an increase in the amount of greenhouse gases that affect seasonal fluctuations or a continuous increase in global temperature. These changing circumstances encourage humans in modern times to look for ways to achieve sustainable development. By being able to meet their needs appropriately and showing environmental friendliness, the World Commission on Environment and Development has suggested that sustainable development is a development model that responds to the needs of the present generation without compromising the ability of future generations to meet their own needs. Every human being should appear aware of the utilization of resources for the benefit of the present generation. and must not waste resources Rather, resources should be conserved by applying existing resources to their full potential (Turner, 1993), in line with sustainable development guidelines. By combining the needs of human beings in the economy. society and ecological sustainability go hand in hand (Laurance, 1998; Egwutvongsa, 2021).

The United Nations pays attention to the problems arising from human economic development that cause damage to the environment and lead to conditions that have both short-term and long-term impacts on the environment. The seasonal variations and increasing drought of the world today and in the future create many problems, such as the decrease in rainfall. food shortage poverty the problem of environmental degradation and the problem of increasing sea temperature, etc. Many of these environmental problems have continued to increase in number and intensify. All of which are the result of the rapid development of human beings in the 21st century which has accelerated the rate of development so rapidly that it has caused enormous interference with natural resources.

The United Nations established the World Commission on Environment and Development (World Commission on Environment and Development) to strike a balance between environment and development. By calling on all countries to jointly change their lifestyles to show their shared responsibility to the environment. And Thailand has signed the 21 Action Plan (Agenda 21), which is a global main plan in which member countries must be aware of environmental issues and prioritize environmental protection to create sustainable development in the world (Takala, 2007; Bouma, et al., 2012).

In Thailand at present, there has been a large number of areas for the development of livestock farming. In there are 9,634,430 cows and buffaloes raised in 2022, or 1,377,717 farmers, with an increase of about 4.23% from 2021, and with this increase in farming volume has affected The environmental impact is quite severe because comparing the average amount of cow dung per cow at 16.80 kg per day, it is found that there is 161,858,424 kg of cow dung per day. Excreted cow dung produces methane and carbon dioxide, which are constituents of long-term environmental impacts. Considering emissions, the amount of carbon footprint is 8.713 kg carbon dioxide equivalent (CO_2e) per one cow/1 day, and this may have a serious impact on the environment that can create a greenhouse effect. increasing at an exponential rate due to an increase in the amount of aquaculture to be used for food production throughout Thailand (Zhang, et al., 2022; Chadwick, et al., 2011).

Therefore, this research aims to develop a machine that can reduce the amount of methane and carbon dioxide generated by the fermentation of cow dung in large-scale livestock farms. The newly developed machinery reduces fermentation and generates greenhouse gases. Bringing cow dung that occurs each day to be processed by machinery into dry cow dung that is suitable for use in the agricultural sector in the form of fertilizer or storage for sale to generate income for farmers on the other hand The newly developed process with the convenience of machinery converting cow dung into storage suitability and spurring the demand for more use of cow dung among farmers. cattle of Thailand This is another way to reduce the impact of methane and carbon dioxide emissions from cow dung. It is also a solution to sustainable environmental problems for farmers and can also meet the sustainable demand for meat and milk cows in the future. This is an expression of the management of natural resources to create a balance to properly meet the needs of today's human beings and to increase opportunities for humans in the future who can still use the resources they need. as well.

Figure 1: A large livestock that appears in cultivation in Thailand.
Source: Author

2. Objectives

To develop a cow manure separate machine for large-scale livestock towards an environmentally friendly economy.

3. Methodology

Conduct research by defining the research concept. Define research scope Search for relevant research. Break down product issues to design a product to develop a cow manure separate machine for large-scale livestock towards an environmentally friendly economy, using multiple linear regression and confirmatory factor analysis (CFA) as tools to conclude the best way to create a product.

4. Research Framework

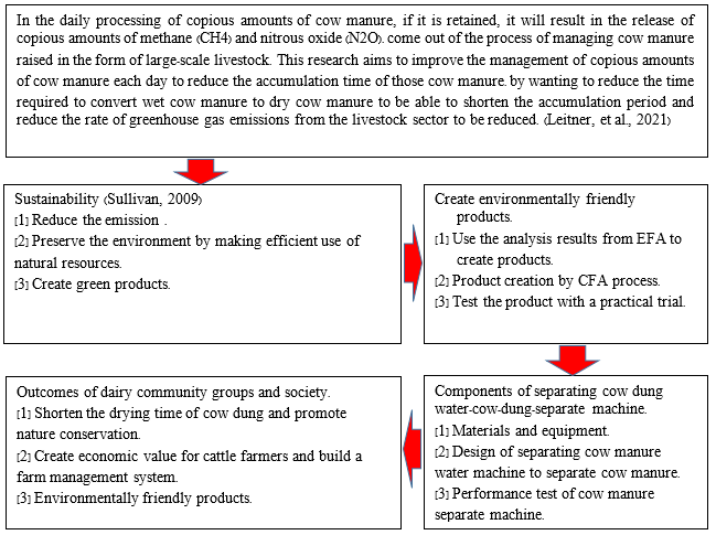


Figure 2:

4.1 Research Scope

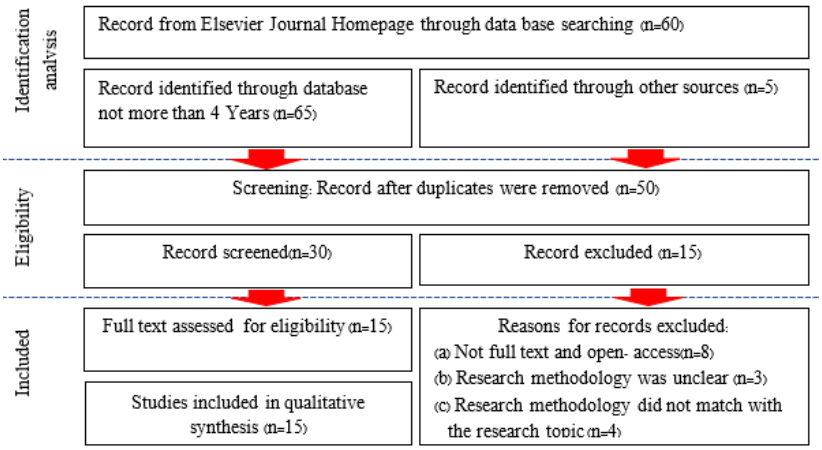
To study the needs and trends of farmers' needs for developing the utilization of cow dung. It collects information to study the needs and satisfaction arising from the development of guidelines for converting cow dung so that it can be sold and stored for sale as organic fertilizer to farmers who grow crops in adjacent areas. can be side by side.

- Population: Dairy farmers in the area of Nakhonratchasima province, Thailand. amounting to 4,994 people (the number of registered farmers. 2021)
- Sample group: In a group of dairy farmers in the Pak Chong district of Nakhonratchasima province, Thailand, in the amount 357 people.
- Research tool: A structured questionnaire that inquired about farmers' needs and satisfaction with dairy manure processing machines. It is a 5-level rating scale questionnaire of Likert. And there is confidence with the alpha coefficient (Cronbach's Alpha) = 0.902, considered at a proficient level.
- Data analysis: By applying mean, standard deviation, multiple linear regression, and confirmatory factor analysis (CFA).

4.2 Literature Review

Studying to develop the process of utilization of dairy cow dung. Increased economic value and environmental friendliness. By finding information from research related to the development of cow dung processing machines The researcher has systematically compiled relevant research papers to study and develop the process of using dairy cow dung. Increased economic value and environmental friendliness. using keywords "Sustainable Communities" "Greenhouse Gases" "Dairy Manure" and "Dairy Manure Processing Machine" Control the search for relevant research from the above information to not exceed four years. 65 relevant research articles were found, after which 30 were selected. Articles Then, 15 articles related to studies were selected for the development of the dairy cow dung utilization process. Increased economic value and environmental friendliness. It consists of the following criteria: (a) complete research with an open-access format: (b) a research method that is unclear: (c) a research method that does not correspond to the research topic.

Table 1: Procedures for screening research articles related to research.



Source: Author

Conduct a review of all collected literature to bring a conceptual framework into determining the factors that may affect the needs of large-scale livestock farmers. When analyzing, it was found that the research paper tends to show four factors that participate in the emergence of demand for and farmer satisfaction with cow manure processors in large-scale cattle farms. The result will lead to the development of a cow dung processing machine that can meet the needs of farmers and help create economic returns for farmers in another way.

Table 2: Literature review according to the 4 conceptual frameworks.

Author / Year	A			B		C			D	
	1	2	3	4	5	6	7	8	9	10
1. Samavati, Z., et al. (2023)	✓	✓	✓	✓	✓		✓	✓	✓	
2. Chu, X., et al. (2022)	✓	✓	✓		✓	✓	✓	✓	✓	
3. Xu, B., et al. (2020)	✓		✓			✓		✓	✓	
4. Wang, W., et al. (2020)	✓	✓	✓	✓	✓		✓	✓	✓	✓
5. Yun, B., et al. (2020)	✓		✓		✓	✓	✓	✓	✓	
6. Kabugo, J., et al. (2020)	✓	✓	✓	✓	✓		✓	✓	✓	✓
7. Behnood, A., et al. (2020)	✓		✓		✓	✓	✓	✓	✓	✓
8. Abrosimov, K., et al. (2020)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9. Li, X., et al. (2023)	✓	✓	✓		✓	✓	✓	✓	✓	
10. Huo, C., et al. (2023)	✓	✓	✓	✓	✓	✓	✓	✓	✓	
11. Gebousky, O., et al. (2023)		✓		✓		✓		✓	✓	✓
12. Aida, M., et al. (2023)		✓		✓		✓		✓	✓	✓
13. Forouzesh, M., et al. (2023)		✓		✓		✓	✓	✓	✓	✓
14. Zhao, W., et al. (2023)	✓	✓	✓	✓	✓	✓	✓	✓	✓	
15. Liu, N., et al. (2023)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total	12	12	12	10	11	12	12	15	15	8

**A=Show sustainability, B=Reduce greenhouse gases, C=Separation liquid and solid of cow manure, D=Consumer engagement

Source: Author

The results from the analysis can be summarized as follows. [1] Preserve nature and the environment by utilizing natural resources worthily, [2] Create a farm management system, [3] Environmentally friendly products, [4] Reduce the drying time of cow dung, [5] Reduce the emission, [6] Separation liquid and solid of cow manure machine, [7] Create green products, [8] Machine officialness, [9] Creating economic value for dairy cow farmers,[10] Reduce disease carriers to the dairy cow.

The analysis was to study the relevant factors to develop the process of utilization of dairy cow dung. Increase economic value and environmental friendliness through a systematic review of research papers. The factors can be summarized as follows:

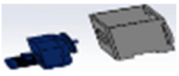
1. Sustainability: It was found that fifteen selected studies mentioned this factor as a crucial factor and related to "Conserving nature and the environment by utilizing natural resources wisely" contains twelve articles showing awareness to make the best use of resources. and does not destroy nature and the environment moreover "Create a farm management system" contains twelve articles. There is a management plan to create benefits from natural materials that are used to create products and prototypes. You must plan and create a management system as comprehensive as possible. including the factor of "Environmentally friendly products" contains twelve articles, taking into account the choice of materials. To create products and prototypes for the most cost-effective and biodegradable back to nature. It is not a pollutant that is toxic to the environment.
2. Greenhouse gas reduction: It was found that fifteen selected studies mentioned this factor

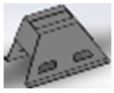
as a crucial factor and related to "Reduce the drying time of cow dung" contains ten articles related to the design and construction of products and prototypes. Focusing on reducing the time to use materials and in the section on "reducing carbon dioxide and methane emissions into the atmosphere," 11 articles are considering the reduction of greenhouse gases. and reduce global warming. It is an integral part of the design and construction of products and prototypes.

3. Solid-liquid separation of cow dung: It was found that fifteen selected studies mentioned this factor as a crucial factor and related to the "cow-liquid-solid separator". Twelve articles were like the system. separation of solids and liquids most of them brought things. and natural materials to design and create products and prototypes. There are twelve articles on "Creating Environmentally Friendly Products", which use natural materials and materials to design and make products and prototypes. considering the degradation system of the product back to nature with no toxic pollution promotes the fertility of forests and ecosystems. In the efficiency of machines section, fifteen articles consider the efficiency of the products that can be created to produce the most cost-effective and work at full efficiency. suitable and meet the needs.
4. Consumer participation: A selection of fifteen studies identified this factor as an important and relevant factor. "Creating economic value for dairy farmers" contains 15 articles focusing on the economic system. livelihood of the population to have a better well-being There are eight articles in the section "Reducing disease carriers to dairy cows" focusing on hygiene. prevent the occurrence of pathogens systematically managed.

Take the conclusions that affect the needs of farmers into the step of creating an innovative dairy manure processing machine that is environmentally friendly. By bringing in the creation of new product design concepts with Scamper Analysis for the development of cow dung converters that show environmental benefits and help generate income for farmers in converting cow dung to use in agriculture. cultivate plants in the neighborhood.

Table 3: The creation process of a new environmentally friendly cow manure processing machine product.

Criterion	Development Process	Development Concept
Substitute	1. Solve the problem in the cow dung farm. 2. Reduce time. 3. Add economic value.	
Combine	1. Machine complete sets. 2. Easy to operate. 3. Easy to maintain.	
Adapt	1. Easy delivery. 2. Adaptor for connecting external equipment. 3. Can operate with 1-phase and 3-phase electric.	
Magnify	1. Performance gear set. 2. Screw thread performance. 3. Material performance.	
Minify	1. Suitable size for medium and small farms. 2. Reduce materials to build. 3. Reduce electrical equipment.	
Eliminate	1. Reduce complex equipment. 2. Reduce complex control circuits. 3. Select a device available within the country.	
Elaborate	1. There is a working indicator light. idle state and abnormal state. 2. The compressed screw housing is easy to service. 3. The gear housing is easy to service.	

Criterion	Development Process	Development Concept
Rearrange	1. The cow dung compression device is corrosion-resistant stainless steel. 2. The frame parts are made of steel to reduce material costs. 3. The drive gear is directly connected to the screw for precision and efficiency.	
Reverse	1. Use a set of mechanisms to set the moisture level of cow dung. 2. Use a coupler to bring the cow dung from the outside into the unit. 3. Equipment can be disassembled and moved easily.	

Source: Author

Take the results of the new product creation with the SCAMPER technique to find innovations that can be incorporated into the conceptual design of a cow dung manure separate machine in large-scale livestock farming areas.

Table 4: Design guidelines for cow manure processing machine for farmers' floor large cattle farm.

Product creation guidelines from the SLR literature review	Diagnose problems with the design selection process. SCAMPER	Design inspiration. GOAL
1. Show sustainability.	1. Long service life equipment	1. Solve problems in the cow dung farm.
2. Reduce greenhouse gases.	2. Use electric control.	2. Reduce greenhouse gases from cow manure.
3. Separation of liquid and solid of cow manure.	3. The mechanism is not complicated, and easy to maintain.	3. Choose to use equipment that is available in the country.
4. Consumer engagement.	4. Reasonable price meets the needs.	4. Reduce farm management problems and create added economic value.

Source: Author

Table 5: Farmer's satisfaction with the prototype of a new large-scale cow manure processing machine.

Farmer's satisfaction assessment	Mean	S.D.	Level of satisfaction
Facter1: Machine property (MCpropo)	4.296	.584	very satisfied
Facter2: Machine efficiency (MCef)	4.270	.592	very satisfied
Facter3: Machine image (MCim)	4.282	.592	very satisfied
Sum	4.419	.594	very satisfied

Source: Author

The sum satisfaction of large-scale livestock farmers showed an elevated level of satisfaction with the newly developed cow dung processing machine ($\overline{X}$ =4.419; S.D. =.594). First, farmers were highly satisfied with the properties of the newly developed cow dung processor ($\overline{X}$ =4.296; S.D. =.584). Second, farmers were highly satisfied with the appearance of newly developed cow dung separate machines ($\overline{X}$ =4.282; S.D. =.592), and third. Farmers were highly satisfied with the efficiency of the newly developed cow dung separate machine ($\overline{X}$ =4.282; S.D. =.592).

For predicting the satisfaction of large-scale livestock farmers with cow manure processors. To consider all three factors, three independent variables were assigned: 1) MCpropo [Machine property] 2) MCef [Machine efficiency] 3) MCim [Machine image] and the dependent variables were the satisfaction of farmers. cow's dung, a new prototype, where the model test values were evaluated, and

both independent variables appeared. The dependent variable was able to predict 84.8% (R Square=.719; R = .927; adjusted R square = .717), which met the minimum threshold of 70%. Explained the variance in satisfaction of farmers at 84.8% (explained with statistical significance).

Table 6: Analysis of Multiple Regression Analysis of Factors Affecting Design Guidelines for new large-scale cow manure processing machine.

Design factors of cow dung reprocessing machine		SS	Degree of Freedom	MS	F test statistics	Sig.
1	Regression	89.653	3	29.884	298.696	.000
	Residual	35.017	350	.100		
	Total	124.670	353			

Source: Author

Table 7: Results of multiple regression analysis (Stepwise multiple regression analysis)

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
							Tolerance	VIF
		B	Std. error	Beta				
1	Constant	-1.20	.189	-	-6.366	.000	-	-
	X1: MCpropo	.460	.029	.453	15.683	.000	.962	1.040
	X2: MCef	.385	.029	.384	13.216	.000	.950	1.053
	X3: MCim	.466	.029	.465	16.236	.000	.977	1.023
R=.848, R^2=.719, Adj R^2=.717, SEE=.189								

* p < .01

Source: Author

The results showed that MCpropo [Machine property] (β=.460, t=15.683, P-value=.000), MCef [Machine efficiency] (β=.385, t=13.216, P-value=.000). and MCim [Machine image] (β=.466, t=16.236, P-value=.000). All three factors can influence farmers' satisfaction with cow dung processing machines for large livestock. statistically significant at .01

The results of the analysis of three factors affecting the satisfaction of farmers towards the cow dung processing machine for large livestock. Using multiple regression analysis, MCPropo (machine properties), MCef (machine performance), and MCim (machine image) were positively influenced by all three factors. Farmer's satisfaction and could together explain the variance in farmer's satisfaction 71.9%. MCim had the most effect on SUM, followed by MCpropo and MCef.

Regression equation in raw score form.

$$\hat{y} = -1.20 + .460(X_1) + .385(X_2) + .466(X_3)$$

Regression equation in standard score form.

$$Z = .453(X_1) + .384(X_2) + .465(X_3)$$

Confirmatory component analysis procedures (Confirmatory factor analysis) by investigating the structure of factors affecting the level of satisfaction with the cow dung processing machine for large livestock. It wanted to consider the correlation between individual factors that affected the degree of satisfaction among livestock farmers.

Step 1: Conduct a first-order analysis. Factors affecting the satisfaction of large-scale livestock farmers. By evaluating the measurement model from three factors affecting the choice of use of the newly developed cow dung processor. In the form of analyzing the co-influence of each of the three observational variables that tend to affect the satisfaction that occurs with farmers using the cow dung processing machine.

Table 8: First order to analyze the co-influence of each variable to build the machine.

Latent variable / Observable variable	MCpropo			MCef			MCim			r^2
	$ß_i$	b_i	*SE*	$ß_i$	b_i	*SE*	$ß_i$	b_i	*SE*	
[A] Strong and resistant to corrosion.	.941	.968**	.076	-	-	-	-	-	-	.885
[B] Easy to repair and maintain.	.962	.986**	.072	-	-	-	-	-	-	.925
[C] Rustproof material.	.931	1.000	-	-	-	-	-	-	-	.868
[D] Work all the time.	-	-	-	.883	.918**	.171	-	-	-	.781
[E] Surge protection.	-	-	-	.886	1.000	-	-	-	-	.785
[F] Adjust the moisture content of cow dung.	-	-	-	.558	.792**	.200	-	-	-	.312
[G] The machine structure looks good.	-	-	-	-	-	-	.838	.992**	.120	.701
[H] Look easy to use.	-	-	-	-	-	-	.968	1.000	-	.937
[I] Standard keypad colors.	-	-	-	-	-	-	.752	.822**	.123	.565

Latent Variable	Build Machine			R^2
	$ß_i$	b_i	***SE***	
MCpropo	.349	.486	.457	.122
MCef	.504	.515	.474	.254
MCim	.785	1.000	-	.617

** P < .01

Source: Author

The results of the second confirmatory factor model analysis of the factors affecting the design approach of the cow dung processing machine for large livestock for sustainable development responses by the green economy concept that is friendly to the earth are found in the analysis. The resulting model appeared to be aware of its application, namely 1) the quality factor of the cow dung processing machine. 2) Efficiency factor of cow dung processing machine 3) The image factor of the cow dung reprocessing machine, in all 3 factors, there are important components, the confirmatory component of the criteria of Diamantopoulos & Siguaw (2000), in which the consensus index of the second-order confirmatory component model passed the specified criteria (Schumacker & Lomax, 2010) according to the following criteria: χ^2 >0.05, relative χ^2 ≤2.00, GFI≥0.95, AGFI≥0.95. , RMSEA≤0.05. It can be concluded that Factors affecting the design of the cow dung processing machine for large livestock have been developed to meet the needs of cattle farmers in Thailand appropriately according to the specified conformity index criteria. Build machine factors consist of three components: (1) Machine property factors measured from three observed variables, namely [A] (Strong and resistant to corrosion.), [B] (Easy to repair and maintain.), [C] (Rustproof material.), (2) The factors of machine performance measured from three observational variables, namely [D] (Work all the time.), [E] (Surge protection.) and [F] (Adjust the moisture content of cow dung.), and (3) The factors machine image measured from two observed variables, namely [G] (The machine structure looks good.),[H] (Look easy to use.), and [I] (Standard keypad colors.)

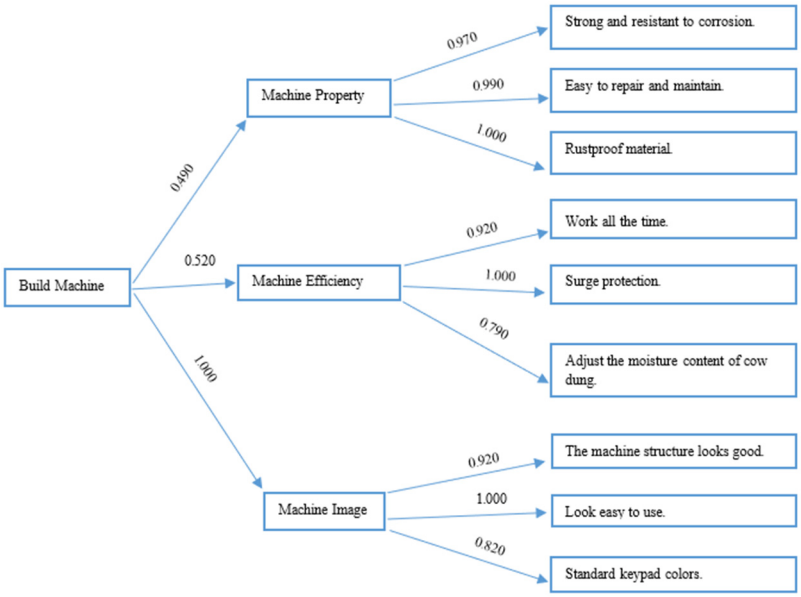


Figure 2: Second order of building machine factors.
Source: Author

5. Results

Creating a newly developed cow manure separate machine for large-scale livestock towards an environmentally friendly economy from the process according to methodology produces products that meet the needs of farmers as shown in the picture below. which tests actual use by separating water and cow dung waste. which the machine can adjust the dryness level of cow dung moisture and the cow manure that was obtained was tested for plant nutrients. To guide research by using cow dung. to be a component in making fertilizer pellets or as a component in related research.

Figure 3: Production process and use of a prototype of a new large-scale cow manure processing machine.
Source: Author

Table 9: Cow dung analysis results are obtained from the new large cow dung processing machine.

Manure	Total nutrient content (%)			Moisture Content by fresh weight[4] (%)
	Nitrogen	Phosphorus	Potassium	
Cow dung analysis result	0.97	0.65	0.23	70.81

Source: Author

According to the analysis result of the cow dung that has been transformed by a new large-scale livestock cow manure processing machine by separating the water and cow dung from each other, the nutrients can be analyzed as fertilizer for plants, and moisture of the cow dung that appears, the nitrogen 0.97%, phosphorus 0.65%, potassium0.23%, and moisture 70.81%. that can bring cow dung from separating the water and cow dung from each other from a new large-scale livestock cow manure processing machine, Use as organic fertilizer put into the soil increases organic carbon and organic nitrogen, and increases in organic matter helps to improve the soil structure and can also manage long-term soil fertility (Boujila and Sanaa, 2011). A new large-scale livestock cow manure processing machine can help reduce carbon dioxide and methane gas from the accumulation of cow dung in the atmosphere of the world. Helps reduce greenhouse gas. Helps to maintain nature and the environment by causing the environment in the area that raises cows to reduce the foul odor of cow dung, causing farmers to increase their income. Resulting in a reduction of illness from inhalation of methane, and carbon dioxide gas Make the hygiene of cows and farmers and housing communities in that area benefit from products from the new large-scale livestock cow manure processing machine. [1] Inorganic fertilizer side. [2] Commercial side in selling cow dung. Which is to maintain nature and the environment with the value of natural resources worthwhile Is the creation of non-pollution to the environment, which is sustainable development (Sullivan, 2009), with products that can be used in a variety of ways as follows. [1] It is a fertilizer for plants. [2] Packed in a bag for sale. [3] Take it as an ingredient in making organic fertilizer. by the new large-scale livestock cow manure processing machine. This new development can reduce the problem of the duration of cow dung drying by the sun. The duration of the sun to dry dairy dung with natural methods will take longer depending on the weather Therefore, the accumulation process and the growth of microbes and fungi. But this newly developed separate water and separate cow manure machine. can separate the water and separate cow manure at a suitable humidity level and prevent the accumulation of cow dung, which causes fungi, and also reduce activities in the farm that cause greenhouse gases in the atmosphere.

6. Discussion

The results of this research are all the result of the awareness of the farmers' responsibility towards the environment. This is the result of farmers getting to know environmental news from around the world. It is also affected by seasonal fluctuations that result in periods of drought or flash floods throughout the period 2021-2022 in which Thailand experiences seasonal fluctuations that affect daily life. farmer's day with today's communication technology, resulting in farmers being able to receive environmental news from around the world. This creates awareness of the importance of environmental conditions that need to be paid more attention. This has even resulted in large-scale ranchers becoming more aware of the impact of copious amounts of cow dung on their farms. has been a part of the problem of the greenhouse effect. This is in line with the concept of farmers' awareness of their impacts (King, C.D., et al., 2022; Egwutvongsa, S., 2021). This is in line with the level of demand to be met. The cow dung separate machine helps create a sense of environmental responsibility by minimizing impacts. from waste generated within their own cattle farm (Dong, H., et al., 2023; Egwutvongsa, S., et al., 2021). to strengthen farmers in rural areas. This is considered the beginning of the environmental responsibility of individuals in society.

The new cow dung processing machine can reduce the process of cow dung fermentation. It

responds to the economic development policy that is responsible for the environment of Thai society (Sapbamrer, R., et al., 2023). which can create sustainable benefits for farmers and their communities widely the development of new cow dung converters will help the growth of a green economy that can generate long-term economic and environmental benefits. which is a way to develop the potential of farmers who operate large livestock farms to expand the types of products generated from their farms in the form of using cow dung waste to generate income. Until it can cause sustainability in terms of income and sustainability in terms of the environment in the form of enhancing competitiveness in terms of conservation (Green productive capacity) (Suwanmaneepong, S., et al., 2023).

As a result of the research, the new dairy dung reprocessing machine can increase the economic value of cow dung and reduce the methane emissions generated by the daily bulking up of cow dung. efficiently These will show environmental friendliness that can help solve problems for dairy cow dung farmers. To be able to produce quality products according to the standard. It also contributes to house cleanliness which will benefit cattle health in such a way that it does not contribute to the accumulation of disease vectors. It has the nature of the relationship between the environment and the surrounding society that facilitates the emergence of shared environmental responsibility (Lertchamchongkul, T., et al., 2022; Piromgarn, T., et al., 2023) and The new cow dung processing machine will reduce the steps in bringing cow dung to work or storage This will help achieve positive results as follows. 1) Reduce the time in the sun. 2) Reduce the labor cost of workers 3) Reduce the number of workers in processing cow dung. 4) Reduce the amount of methane and carbon dioxide emissions. 5) Reduce the cost of maintenance of machinery for removing dairy cow dung from the barn. 6) Reduce the area for drying cow dung. These 6 positive outcomes will reduce methane and carbon dioxide emissions. into the atmosphere which can help solve global warming and the greenhouse effect overall.

7. Conclusions

Development of a process for the utilization of dairy manure to add economic value and create environmental friendliness. From the summary of the SLR systematic literature review of 87 research papers, it can be summarized the key factors of researchers around the world have given importance to applying those factors to create works that express the friendliness of the world as follows: [1]The importance of sustainability Found 15 research papers that aim to present the main issues of research operations that focus on conservation of nature and the environment by presenting the use of natural resources with value. [2]The importance of raising awareness is Found in 12 research articles aiming to present the issue of showing awareness of the use of natural resources for maximum benefit and not destroying the surrounding nature. [3]The importance of farm system management Found 12 research papers aiming to present the issue of designing a management plan to create benefits from natural materials. [4]The importance of creating environmentally friendly products. Found twelve research papers that aim to present the conceptual issues in selecting natural materials to create products that can demonstrate economic value and can be biodegradable without being toxic to the environment. [5]The importance of greenhouse gas reduction is Found in 15 research papers focusing on the issue of developing the process of converting cow dung in livestock land for utilization. [6]The importance of developing a method to reduce the drying time of cow dung. Found ten research papers focusing on presenting the issue of the development of the process of converting cow dung from livestock to be applied in agricultural activities. and development of products that convert cow dung [7] The importance of reducing the emission of carbon dioxide and methane into the atmosphere from cow dung. Found eleven research articles that focus on presenting the issue of reducing greenhouse gases and reducing global warming.

From the analysis, the knowledge developed in the process of converting cow dung is used in many local areas such as fertilizer for crops and distribution, etc. Local utilization is the goal of the research. All who want to demonstrate processes in which cow dung can be adapted to meet the

needs of individuals in their local communities. To create a system for the use of renewable resources within a large livestock area. This is considered a circuit that can show high environmental friendliness.

So, in summary, we have found a goal that researchers can see together in the processing of cow dung of large-scale livestock. Will want to express five issues: 1) transformation by local people and using the results from the transformation that have been used within their locality. 2) Transformation that develops economically viable machines 3) Processing that shortens the processing time 4) Transformation that converts cow dung from liquid to solid. 5) The transformation must be a process that produces environmentally friendly results, etc.

By taking the goals from the five aspects to develop a concept for designing a new cow dung processing machine with the SCAMPER technique to meet the goals (Goal) set when producing a prototype and evaluating it on a group of farmers who raise cattle in the form of livestock. generous size the farmers were satisfied with the new cow dung processing machine at an elevated level. This is because farmers expressed their satisfaction with the properties and appearance of the newly developed cow dung desiccator after its use in the dung desiccation. When considering the relationship of the goals in five aspects, the goals can be combined into the factors that affect the satisfaction of farmers in the amount of three factors. The machine image factor (MCef) and the machine image factor (MCim) positively influenced the satisfaction of large-scale livestock farmers (SUM). farmers (SUM) at 71.9 percent, with the image factor of the machine (MCim) affecting farmers' satisfaction (SUM) the most, followed by the machine property factor (MCpropo) and machine efficiency factor (MCef).

When all 3 factors were used for confirmatory component analysis, (Confirmatory factor analysis) has a correlation index of the model according to the criteria of Schumacker & Lomax (2010), which is $\chi^2 = .874$, df = 4, relative $\chi^2 = .219$, p-value = .928. RMSEA = .000, RMR = .004, GFI = .996, AGFI = .956, NFI = .998, TLI = 1.078, PGFI = .089, RFI = .980, AIC = 82.874. With the results from the conclusions of this research, the satisfaction of large-scale livestock farmers towards the new cow dung processing machine is the result of three factors: 1) the property factor of the machine; 2) the machine performance factor, and 3) the image factors of the machine.

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