http://jurnal.yudharta.ac.id/v2/index.php/jkie

Journal of Industrial Engineering Knowledge

ISSN : 2541-4461 ISSN : 2460-0113

GREEN PRODUCTION ANALYSIS FRESH MUSHROOMS PRODUCTS AT PT. ETR

ABDUL GHOFUR [a] M. Imron mas'ud [b]

[a] Department Industrial Engineering , Yudharta University Indonesia

[b, c] Department of Mechanical Engineering , Yudharta University Indonesia

Writer Related : abdul.gho89@yahoo.com

Article Info

Article history

Accepted : June 23, 2022

Revised : July 14, 2022

Accepted : July 27, 2022

Published : August 24, 2022

Keywords :

Mushrooms, Green production

ABSTRACT

Along with Development of the industrial world which is increasingly advanced with the increasing number of industries that have sprung up because of the wide open market share, the greater threat to environmental sustainability is because of industrial companies engaged in the cultivation of champignon mushrooms agriculture, located on the slope of Mount Bromo with an altitude of 1,300 masl . The company started its business in 1999 by cultivating button mushrooms on a trial scale and meeting local market demand. On December 9, 2001, its business expanded from a capacity of 2 units to 6 units to meet national and international market demand (ETR, 2019). The process of implementing green production at PT. ETR in the Cultivation Division can be said to be running because all raw materials and products are environmentally friendly. However, the implementation is implementing green production. Its implementation only refers to energy saving and production cost mapping (GVSM) approach. The purpose of this study was to analyze the green production of fresh mushrooms produced by PT. ETR.

DOI: https://doi.org/10.35891/jkie.v10i2. 6187

1. Introduction

As the industrial world develops , the number of industry the more increase because of the open market width . However , this This impact on sustainability environment consequence waste production , good in the form of waste solid , liquid , and gas. Waste This cause pollution air , land and water.

As response , the Indonesian government issued Minister of Industry Regulation No. 39 of 2018 concerning Green Production, which aims reduce impact pollution from waste industry . Green production is system production friendly an environment focused on efficiency energy , conservation source power , and minimization waste , as well as can increase image and efficiency company .

PT. ETR is company agro-industry that cultivates champignon mushrooms on the slopes Mount Bromo since 1999. Its products marketed to local and international markets , including the United States , Japan , and Europe . In its production , PT. ETR has apply principle friendly environment , but Not yet fully referring to green production criteria .

Waste test results liquid show that some parameters such as COD, BOD, and TDS are still exceed standard quality , so that required Handling more continue . This indicates that The implementation of green production at PT. ETR, especially in the Cultivation Division , is not yet optimal and is still need improved . Further study carry on expected can push more green production implementation good in the industry .

2. Review Literature

Gap and Position

Gap analysis is comparison performance current with performance potential used For determine steps to be taken taken For reach a conditions in the future come . As method , gap analysis is used as tool evaluation business that focuses on gaps performance company moment This with performance that has been targeted previously , for example , which has listed in the plan business or plan annually in each function company . Analysis gaps also identify actions What only what is needed For reduce gap or reach expected performance in the future . In addition , the analysis This estimate time , cost and resources required For reach condition expected company . Gap analysis consists of from three component factor main namely : 1). list of characteristics (such as attributes , competencies , levels performance) of situation now (what is the moment) this), 2). list what is needed For reach future goals (what to do), and 3). list of gaps what is there and what is needed filled in . (Adi S, 2015).

Mold

Mushrooms are product horticulture growing and developing on compost media , Production process started from making compost media that passes through a number of process stages and phases , then making and preparation seeds of cultivation sprinkle into compost media until the growing process flower mold until the harvest process is carried out manually and end with demolition media compost For mushrooms that have No productive For Then replaced with new planting media . PT. ETR is one of the company with product Mushroom Featured with Champignon type or mold buttons used writer as places and objects study .

Green production

Aspect *Green production* in study This explain about assessment of the production process that has begun from the flow of materials to *the finished goods* process is a process of giving minimal impact on environment around as well as give great contribution to environment social around place production . *Green production* or product green is one of step the government must run by all perpetrator industry Good manufacturing or services . PT. ETR is company mold with a complex process from upstream until downstream . So that need done study use know implementation of green production in every stages production .

Green Value Stream Mapping

The green value stream mapping (GVSM) method is a the method used For to smoothen material and information flow use increase productivity as well as Power compete and help company in apply more system good.In matter This do mapping flow mark in a way Details use identify waste and provide solution For remove or reduce it .

Green production

The term “Green ” or green often We meet in discussion life everyday . Moreover moment This Again intense – intense issue *eco-friendly, Green Manufacturing* and *Global warming* .

According to Tsai et al. 2014, *Green Production* or production green is A a dynamic and comparative concept involving the process of improvement in a way periodic and sustainable . This green production usage oriented back to green product for minimize use material raw and produce waste in amount little can controlled at every production process stages so that safe for environment .

3. Methodology

Study This conducted at PT ETR a business mushrooms located on slopes Mount Bromo, Pasuruan . Location selected in a way special Because company This show significant indication in the production process mushrooms ,. Access granted company For do observation direct and data retrieval becomes consideration main in election location study This .

Primary Data

Primary data is the main data used in research . This data obtained from observation and research in a way direct in the field , in study This data was obtained with method as following :

- **Interview**

  In the method this , researcher do interview with respondents in the section production and management of PT. ETR Cultivation Division .

- **Observation**

  In this study , data was collected based on observations of the objects being studied in a way directly . Observations made is observing the production process , the process of use power , handling waste and so on .

- **Questionnaire**

  Sheet containing questions – questions that are addressed to related parties with green production. Respondent from questionnaire the is the Cultivation Division covering Department *Composting* , Department Planting and Department Questionnaire Technique study to *Respondent* as attached .

Secondary data

It is data that is not direct observed by researchers.Data This originate from documentation company or historical data company. The data collected namely *Key Performance Indicator* Data which includes Composting production data , production data Planting , usage data energy and lubricants , as well as usage data medicines . Secondary data collection was also obtained with method studies literature in the form of books , websites, journals , and study previously as support research that will be done .

Sampling determination method

The method for determining the research sample is to use a *non-probability sampling system* with a *purposive sampling technique. Purposive sampling* is a method for determining samples based on specific criteria possessed by the sample (Sumarsono.2004).

no.	Position	Frequency (people)	Percentage (%)
1.	Head part	2	16.67
2.	Head Sexy	7	58.33
3.	Supervisor	3	25.00
	Amount	12	100.00

Data management

The results of this study obtained some of the required data and processed it well so that it is easier to read and interpret. The researcher used descriptive analysis methods, Green Value Stream Mapping (GVSM) and descriptive statistics.

Analysis Descriptive

Is the method used For researching group human , a object , condition , something system thoughts, or a class events that occur in the present . The purpose of analysis descriptive is For give description in a way systematic, actual and accurate about facts studied . Analysis Descriptive in research This used For give description regarding the *green production* process found in the planting process Mushroom Cultivation Division at PT. ETR (Natzir.1999)

Green Value Stream Mapping (GVSM)

Is a method waste identification or waste produced with impact to environment . In the concept This using 7 (seven) indicators which include usage energy , water usage , usage material raw , waste or waste , transportation , emissions and biodiversity or diversity biological

Indicator Types	Data source
Energy Usage	Amount usage PLN power during 2019
Water usage	The amount of water discharge from pump source spring water during 2019
Usage material standard	Amount production material planting media standard during 2019
Waste	Compost data Demolish 2019
Transportation	Transfer process product
Emission	Data on coal and materials usage burn during 2019
Biodiversity	Groundwater pollution analysis

Statistics Descriptive

Is a method data processing only relate with matter to describe or give information about a data.On study This statistics descriptive used For analyze criteria *green production.Based* on results from score answer questionnaire filled out by respondents researcher can know Criteria *green production* at PT. ETR.According to Guttman scale of assessment shared into two parts that is mark highest 1 (one) and value lowest 0 (zero), thing This For avoid existence election the answer tends to be to mark middle .

Identification trend average score categorized into 4 (four) parts (Azwar.2000). This is can seen in the table following :

Score Interval	Criteria
≥ (Mi + 1SDi) Mi s/d (Mi+1SDi) (Mi-1SDi) up to Mi ≤ (Mi - 1SDi)	Good Enough Good Not good Very Poor

Source : Azwar (2000).

Formula ideal mean (Mi) and deviation ideal standard (SDi) of each and every variable is as following :

Mi : ½ (score ideal maximum + ideal minimum score) ……1

SDi : ⅙ (score ideal maximum + ideal minimum score)….. 2

Based on results calculation from the collected data , assessment criteria application of green production in production Champignon mushrooms at PT. ETR can classified into 4 (four)

Score Interval	**Criteria**
≥ 8.6	Good
6.5 to 8.6	Enough Good
4.3 to 6.5	Not good
≤ 4 .3	Very Poor

4. Results and Discussion

PT. ETR is A company agriculture the industry in motion in field planting Mushroom.Capacity production from company This is of 12,500 tons per year . This is is pride for PT. ETR to called as manufacturer or company manager mold the largest in Indonesia.

Machinery and Equipment

For support a production company No Enough If depend on power human , then from That help from machines are also very important things in help a production process . Here is machine data used by PT. ETR :

No.	Tool Name	Qty	Sat	Utility
I. COMPOSTING DEPARTMENT				
1.	Tractor	4	Unit	Transfer compost
2.	Wheel Loader	3	Unit	adul material standard
3.	Loader	5	Unit	Reversal compost
4.	Hopper	3	Unit	Reversal compost
5.	Mixer	2	Unit	Complaint material compost
6.	Record Wagon	3	Unit	Transfer compost
7.	Thermorecord	2	Unit	Temperature control compost
8.	Elevating Conv.	6	Unit	Income kmps toTunnel
9.	Thillot Holland	3	Unit	Income kmps toTunnel
10.	Blower Tunnel	2	Unit	Temperature control kmps
11.	Compost Blower	4	Unit	Aeration in Phase I compost
12.	Boiler	2	Unit	Pasteurization process
13.	Generator	2	Unit	Power backup
II. DEPARTMENT OF PLANTING				

1.	Main Blower	4	Unit	Temperature Control
2.	Additional blower	2	Unit	Temperature Control
3.	Flush pump	5	Unit	Watering fresh mushrooms
4.	Water pump	4	Unit	Watering and sanitation
5.	Sunshine	2	Unit	Fogging environment
6.	Cooling Unit	3	Unit	Decrease temperature room
7.	Vacuum Chamber	1	Set	Reduction of mushroom KA
8.	Digital scales	6	Bh	Weighing product
9.	Sitting scales	0	Unit	Weighing product
10.	Box Truck	4	Unit	Transportation product
11.	Dump Truck	4	Unit	Pick up employee pick

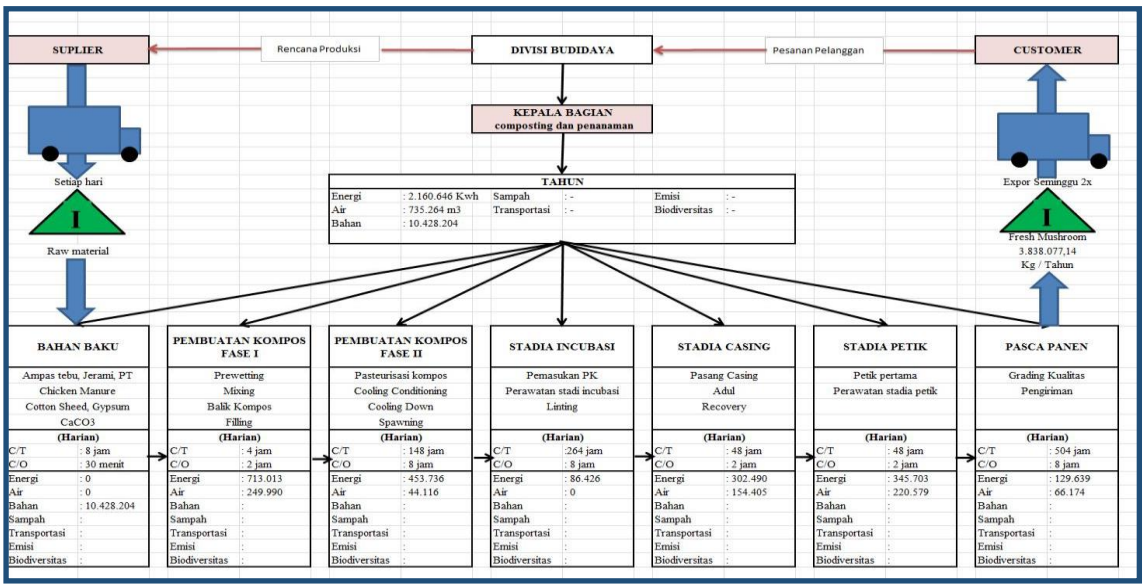
No	Types of Raw Materials	Qty / Unit	Unit	Caption
I. RAW MATERIALS				
1.	Dregs sugarcane	4,000	Kg	
2.	Straw	5,500	Kg	
3.	Top sugarcane	1,000	Kg	
4.	Stem Corn	2,000	Kg	
II. ADDITIONAL MATERIALS				
1.	Chicken Manure	2,300	Kg	
2.	Cotton Sheet	650	Kg	
3.	Gypsum	350	Kg	
4.	ZA	225	Kg	
5.	CACO3	225	Kg	
6.	Casing Land	10,800	Kg	

Measurement waste with Green Value Stream Mapping (GVSM)

Production green or green production is used For knowing the production process that takes into account environment . This is can known from waste the environment consists of from energy , water consumption , transportation , materials , waste , emissions and biodiversity . The results of Green Value Stream Mapping (GVSM) can be identified production process flow fresh mushrooms and related waste direct with environment . This is can shown in the table following :

Types of waste	Production process			Usage per day
	Compost	Planting	Total	
Energy (MJ)	388,916.2	259.277.5	648.194.0	1,775.87
Water (Liter)	220,579.0	514.685.0	735.264.0	2,014.42
Waste (Tons)	-	-	-	-
Transportation (m)	-	-	-	-
Emissions (Ton/CO2/ Hr)	-	-	-	-
Biodiversity	-	-	-	-

From the table above, we can describe the green value stream mapping process shown in the image below:



From the table above, it can be seen that in 1 (one) day of production requires 21,194,00 MJ or 5,887 Kwh of electrical energy . This energy is used for the energy of machines used for the production process starting from making compost media to the compost unloading process, for lighting energy, and the use of office equipment. Water consumption used in the *composting section* (making planting media) is 220,579 liters which is used for the *prewetting process* , adding compost water and sanitation. While in the planting section, 514,685 liters are used for the purpose of watering mushrooms, especially during the casing and picking stages, and sanitation of the planting room and environment. All materials used such as the remaining casing installation are reprocessed and the remaining planting media in the form of used compost is processed into organic fertilizer so that it does not become waste. Transportation is 2500 meters when entering compost or filling, entering PK, the picking process and when unloading compost. However, biodiversity or biodiversity is considered zero because there is no environmental damage.

Green Operating Efficiency

Green operating efficiency in the production process of fresh mushroom cultivation is measured by filling out *a questionnaire* containing 6 (six) questions. The assessment category for the application of *green production* in fresh mushroom production based on the *green operating efficiency criteria* can be seen in the following table:

No.	Question items	Score	Category
1.	Companies use electricity according to production needs	12	Good
2.	The company uses water for production processes according to production needs.	12	Good
3.	Wastewater produced in small quantities	12	Good
4.	The smoke produced from the combustion process is environmentally friendly	12	Good
5.	Solid waste produced in small quantities	0	Very Poor
6.	The amount of product produced is greater than the amount of waste	12	Good

The assessment of the application of green production in fresh mushroom production based on the criteria of green operating efficiency is categorized **as good** because all questions have an average value of ≥ 8.6. The application of green operating efficiency such as the use of electricity in accordance with production needs. This can be seen from the following table and figure:

Month	**Production(Kg)**	**Electricity (KWh)**	**Water(m3)**
January	303.244.22	195.422.00	20,913,40
February	292.470.94	175,684,00	20.170.41
March	318.931.20	187,930,00	21.995.26
April	323.165.74	196.446.00	22.287.30
May	317.883.17	185,674,00	21.922.98
June	278.793.31	149,200.00	19.227.13
July	323,890,75	165,532,00	22.337.30
August	317,584,08	180,787,00	21.902.36
September	347,736,89	175,492,00	23,981,86
October	357.100.83	157,912,00	24,627,65
November	328.165.98	183,552,00	22.632.14
December	329.110.03	206,924,00	22,697.25
TOTAL	**3,838,077,14**	**2,160,646,00**	**264.695.04**

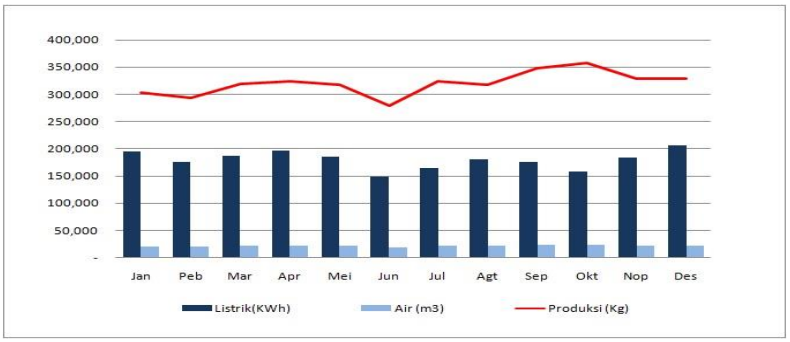
Based on the data above , we need to display a graph *so that it is easy to read and understand :*

In the picture above, it can be seen that the amount of electricity and water used is proportional or directly proportional to the amount of fresh mushroom production. The higher the production, the higher the need for water and electricity. Conversely, if the amount of production decreases, the need for water and electricity also decreases. However, under certain conditions, electricity often experiences blackouts due to heavy rain or fallen trees, so that the amount of PLN KWh decreases even though the amount of production increases, PLN's electrical energy is replaced by a generator engine.

Production data and waste data 2019

Month	Production(Kg)	Amount of root waste (Kg)
January	303.244.22	6,064,88
February	292.470.94	5,849,42
March	318.931.20	6,378,62
April	323.165.74	6,463,31
May	317,883,17	6,357,66
June	278.793.31	5,575,87
July	323,890,75	6,477,82
August	317,584,08	6,351,68
September	347,736,89	6,954,74
October	357.100.83	7.142.02
November	328.165.98	6,563,32
December	329.110.03	6,582.20
TOTAL	**3,838,077,14**	**76,761,54**

In the picture above, it is known that the amount of waste produced is always directly proportional to the amount of fresh mushroom production. The greater the amount of production, the more waste is produced, and vice versa, the lower the amount of production, the waste produced also decreases. However, in general, we can see that the amount of waste is always smaller than the amount of production. The highest peak of production in 2019 occurred in October. The waste produced is in the form of remaining pieces of mushroom roots and casing soil that are included in the mushroom roots and rejected mushrooms during the picking process. Solid waste in the form of roots is collected in one bag container (used sack) to then be sent to the organic department as a mixture of organic fertilizer.



Category evaluation implementation of green production based on criteria protection environment natural company in the production process fresh mushrooms

No.	Statement	Score	Category
1.	The company produces B3 waste (toxic and hazardous materials)	9	Good
2.	The company processes B3 waste (Toxic and Hazardous Materials)	9	Good
3.	The company carries out water channel normalization every time	12	Good
4.	The company carries out emission/pollution tests before the waste from combustion is released into the air.	0	Very Less Good
5.	The company conducts testing of solid and liquid waste pollution levels	7	Enough
6.	Companies use raw materials or resources that are free from pollution.	12	Good
7.	The company is making energy-efficient machine improvements .	12	Good
8.	Companies carry out technological innovations that produce less waste.	12	Good
9.	Companies using fossil fuels	12	Good
10.	The company has a special place for waste processing and recycling.	12	Good
11.	The company conducts quality testing of source water/ground water	12	Good
12.	The company uses ISO 14020 certified packaging (Ecolabel packaging)	0	Very Less Good
13.	The waste produced by the company complies with government regulation number 82 of 2001 concerning water quality management and water pollution control.	12	Good

14.	The company implements ISO 9001 (Quality Management System)	12	Good
15.	The company implements ISO 14001 (Environmental management system)	0	Very Less Good
16.	The company implements FSSC 22000 (Food safety management system)	12	Good
17.	The company implements ISO 50001 (Energy Management System)	0	Very Less Good

Evaluation green production application in production process fresh mushrooms as on with criteria p protection natural company with category **Enough** .

Analysis of the application of green production on fresh mushroom products based on the company's environmental protection criteria is categorized as **quite good** because almost all points are good. Emission tests are not carried out considering that the company does not use fuel only for machines or production tools that do not have a significant impact on pollution (motor vehicle smoke category).

Use Resource Effective production

Effective or appropriate use of resources is the use of production resources including raw materials and energy carried out in accordance with the target to be achieved during the production process. Assessment of effective use of resources on fresh mushroom products is carried out or measured by filling out a questionnaire containing 9 (nine) questions. This can be seen in the following table:

Assessment categories for the application of green production to fresh mushroom products based on the criteria for effective use of production resources

No.	Statement	Score	Category
1.	The company uses raw materials (bagasse, straw, corn cobs) of good quality.	12	Good
2.	Raw materials are wasted in small quantities	12	Good
3.	Companies use production wastewater for reuse	12	Good
4.	Use of spawning plastic according to the amount of compost production	12	Good
5 .	Plastic damage during the spawning process is less than 1%	12	Good
6 .	Companies use solar power as a substitute for PLN	0	Very Bad
7 .	Used planting media compost is processed or reused	12	Good
8 .	Used spawning plastic is processed or reused	12	Good
9.	Used baskets as containers for mushroom picking are reused	12	Good

The assessment of the application of *green production* to fresh mushroom products based on the criteria for effective use of production resources is categorized **as good,** because almost all components included in these criteria can be achieved.

The amount of compost production, use of spawning plastic and the amount of plastic damage in 2019

Month	Production Quantity(unit)	Plastic Usage (Sheets)	Plastic Damage (sheet)	Plastic Damage (%)
January	62	82,741	222	0.27
February	56	74,620	179	0.24
March	62	84,082	195	0.23
April	60	82,482	241	0.29
May	62	80,572	156	0.19
June	56	68,992	150	0.22
July	64	81,216	139	0.17
August	64	92.285	146	0.16
September	62	88,880	133	0.15
October	62	86,545	130	0.15
November	60	94.107	123	0.13
December	60	85,288	123	0.14
Amount	**730**	**1,001,810**	**1,937**	**0.19**

From the data above, it can be seen that plastic usage is above the standard usage amount. This is because the volume of compost produced is much larger than the specified estimate, but is still in accordance with the production amount and plastic damage is far below 1%, which is 0.19%.

Contribution to Society

This contribution to society means the form of participation of industry players to the community in order to succeed in maintaining environmental sustainability in the form of assistance, programs, money and others. The questionnaire in the category of contribution to society contains 9 (nine) questions.

Assessment categories for the application of green production to fresh mushroom products based on the criteria of contribution to society

No	Statement	Score	Category
1.	The company carries out water conservation	0	Very bad
2.	The company carries out solid waste management	12	Good
3.	The company carries out liquid waste management	12	Good
4.	The company carries out waste gas management	0	Very bad
5 .	The company is doing energy saving	12	Good
6 .	The company holds environmental education programs for the community	12	Good
7 .	The company provides education to the public about the use of compost waste.	12	Good
8 .	The company provides donations to the community for environmental activities	12	Good
9.	Communication with the community is going well	12	Good

The assessment of the application of *green production* on fresh mushroom products based on the criteria of contribution to society is categorized **as good,** because almost all components included in the criteria can be achieved.

Green Production Assessment Results

From each of the categories above, it can be summarized as follows:

1Production category assessment results

No	Category Type	Number of Questions	SCORE		Category
			Qty.	Average	
1.	Green Operating Efficiency	10	60	10	Good
2.	Protection of the environment	17	120	7.05	Enough
3.	Effective Use of Resources	9	84	9.3	Good
4.	Contribution to society	10	96	9.6	Good

From the table above, it can be concluded in general that the implementation of green production using green production criteria is categorized as good. However, in terms of environmental protection, continuous improvement is still needed.

5. Conclusion

Based on results research that has been done , then can taken conclusion as following :

1. Implementation *green production* fresh mushroom products analyzed based on production process in a way general Already Good
2. Based on measurement *green value stream mapping* no There is wasted materials , transportation process No too long in the production process and not happen damage environment in the production process .
3. Criteria – criteria *green production* which consists of on green operating efficiency,Usage source Power effective production , and contribution to public all categorized Good Because have score $\geq$ 8.6. While category protection environment natural company rated enough and have score 7.05 because Not yet implementing ISO 14001(system management environment) and ISO 50001 (system management energy) and ISO 14020 on ecolabel packaging . Of all criteria that has a big impact on performance company .

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