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The Utilization of Field Snails into Soy Sauce Ingredients Enzymatically Regardless of the Physical Quality

[*]Mikhael Namas[1], Felisianus Efrem Jelahut[2]

[1] Department of Electrical Engineering Kupang State Polytechnic Kupang, Indonesia.
[2]Department Of Communication Science, University Of Nusa Cendana, Indonesia

Abstract:
Rice soy sauce is a thick liquid made from snail meat juice . Soy sauce can be made in 2 ways, namely, traditionally/fermentation and by adding enzymes. Making soy sauce does not require a particular type of snail . In this research, we will study the use of rice snails to make rice snail sauce enzymatically. The aim of this research is to determine the effect of adding crushed pineapple tubers and fermentation time on the physical, chemical and organoleptic quality of the rice snail soy sauce produced. Proteolytic enzymes can break down and decompose proteins. Bromelain proteolytic enzymes can break down protein molecules into amino acids, enzymes that hydrolyze peptide bonds in the middle. This research used a completely randomized design (CRD) with a factorial pattern with 2 factors and 3 replications. The first factor was the addition of crushed pineapple tubers (10%), (15%), and (20%) and the second factor was the fermentation time (5.7 and 9 days). The results of this research show that when increasing the number of workers from 4 to 6 people, variable costs increase, but the number of rice snails produced increases , therefore the cost per bottle produced (marginal variable coast) decreases. The tendency to increase productivity often occurs when companies initiate production expansion. T et fire This is not the case if the company continues to expand production by continuing to increase the workforce employed.

Keywords: Field Snails, Soy Sauce, Physical Quality, Physical Science, Electrical Engineering

1. Introduction

Indonesia Most of the population in rural areas is certainly familiar with the rice snail (Bellamya Javanica). However, until now farmers generally only know that rice snails are delicious to eat, but do not realize that they are quite high in protein and can be a potential source of protein, which can be processed into products that consumers prefer. Rice snails are generally consumed directly, but in lower quantities compared to sea snails (shellfish). Therefore, recent reality shows that rice field snails are starting to disappear from the market. This may be due to low consumer demand because it tastes less delicious than sea snails, shellfish and the like. However, the use of pesticides has also drastically reduced the rice snail population. Seeing the facts above, if the rice snail is not immediately handled, both in its development and processing, then the population and attention to the rice snail will decrease. When rice begins to be harvested, the rice snail population will increase. Of that amount, relatively little is taken for human consumption, much of the rest is used as food for ducks at planting time. Thus, rice snails can be considered to still have low economic value and this can be improved by introducing rice snail processing which is easy to make, well known and popular with most people, such as soy sauce. It is hoped that with this processing, rice field snails will develop into an economical agricultural product so that farmers will intensively cultivate these rice field snails and can use them as an additional source of income. The use of rice snails as an ingredient for making soy sauce is expected to provide several benefits, namely: 1) Utilizing rice snails which until now are still considered agricultural waste and have not been exploited economically, 2) Diversify nutritious food, because soy sauce is a product that is liked and consumed by everyone and has a protein content of between 2-6%, 3) Opening up new job opportunities, if pursued intensively, because making snail rice sauce is a work project, 4) Increase farmers' income and stimulate the formation of small industries, because snail fields are easy to obtain and the process of making snail rice sauce is easy to do and the capital required is not too large. The use of the bromelain enzyme in the process of making soy sauce from rice field snails is to

help dissolve the rice field snail protein, so that the process of making soy sauce is faster compared to fermentation using yeast and salt in making soy sauce. If making soy sauce by fermentation takes 7 – 10 days, making soy sauce by enzymatic hydrolysis only takes 3 days. Thus, time efficiency is higher. The enzyme bromelain can be used either from the flesh of the fruit or from the pineapple tuber. So if pineapple tubers are used, it is another use for agricultural waste.

From the above background, the problem formulation is 1) How much labor does a rice snail company need for maximum production of rice snails every day and its profits?, 2) What is the total revenue (Total Revenue) by employing the maximum workforce by the Snail Paddy Company?, 3) What is the total profit every day with optimal labor?, 4) What is the total profit if environmental improvement costs are charged per unit of output?. The aims of this paper include 1) Knowing the production profit of a rice snail company every day per person (marginal net private benefit) with an optimal number of workers. 2) Knowing the total revenue (Total Revenue) of the Snail Rice Company with optimal workforce, 3) Knowing the total profit (TotalProfit) of the Snail Rice Company every day by employing optimal workforce, 4) Knowing the total profit if environmental improvement costs are charged per unit of output.

2. Literature Review

2.1 Rice Snails

The rice field snail (Pila scuttata Mousson) can reach the size of a betel nut. The shell is brownish green or blackish in color and is round with a tapered round cone which is sometimes whitish in color. This snail is not yet found in rice fields, swamps at the edge of ditches or grassy and muddy rivers. The distribution center and origin are not yet known with certainty, but this type is below 600 m above sea level. In Indonesia, rice snails are spread from Sumatra to Irian Jaya and the surrounding islands. According to ANONYMUS (1997), the weight of meat that can be eaten from rice field snails is 5-8 grams. This snail is well known as a source of animal protein in most of western Indonesia.

1. Classification of rice snails (Bellamy Javanica)

Species	: Bellamy Javanica
Genus	: Bellamya, Jousslaume, 1996
Subfamily	: Bellamynae
Family	: Viviparidae
Class	: Mollusca
Subdivision	: Invertebrates

Snails belonging to the Vivipiridae family are small to medium sized snails and live in fresh water, such as in ponds/ponds, swamps, marshes, lakes, rice fields and rivers. So this snail can live in flowing water or in still water (dead). Of the various snails that live in fresh water, we can differentiate the types by looking at the different and distinctive shapes of their shells. Bellamya's shell structure is as follows:

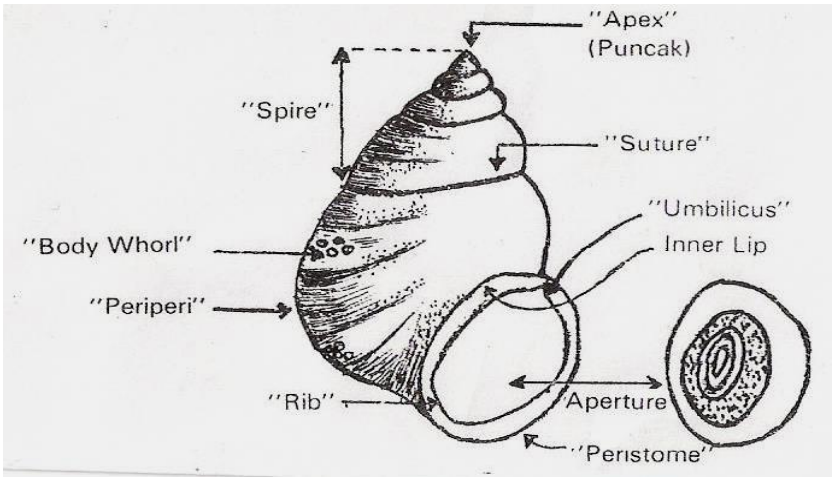


Figure 1. Bellamya Javanica shell structure

2. Rice snail cultivation

This snail reproduces by hatching eggs in the female snail's vaginal tract (ovo-viviparous). The distribution of this snail is in almost every continent except South America. Species from North America, Europe, Asia Minor and North Asia belong to the subfamily Viviporidae. Species from Africa, tropical Asia and Australia belong to the subfamily Bellamynae. These two subfamilies differ in that the male sexual glands are close to

the digestive tract and egg bladder but apart from the digestive glands. In the genus Bellamya the shell is cone-shaped, thin and slightly transparent or not transparent. The flesh of this snail is light gray with yellow and dark gray spots. The eyes are found on the knobs (knobs) on the exterior of the tentacles. The distribution of this genus is in tropical and sub-tropical areas in Asia, Africa and Australia. In the Malaya Islands of the Greater Sunda Islands and not to be missed, although in small numbers they are found in the Lesser Sunda Islands. They can live in fresh flowing water or stagnant water. Local species of Bellamya are usually used for human food and livestock feed, such as ducks (ALONTE, 1993, PHILIPP. Journal. Sci. 19, P , 307), or for bait when fishing. In Java there are two species of Bellamya, namely:

- Bellamya with a slender shell, more greenish brown or greenish yellow, namely Bellamya Javanics.
- Bellamya with a shell that is not slender like Bellamya Javanics, with a bright green color and colored bands on the spirals, namely Bellamya sumatrensis.

3. Spread of rice snails

the Belammya Javanics species is used which is quite widely distributed in various places, namely on the islands of the Greater Sunda Islands, Ambon and the Philippines. The habitat of *Belammya Javanics* on Java Island is generally in lakes - lake, pond - pond, rice fields - rice fields and rivers - river.

2.2 Bromelain Enzyme

Bromelain is a proteolytic enzyme derived from pineapple (*Ananas comosus*) and *Ananas bractaetus* Linn). As a proteolytic enzyme, bromelain is able to break down protein molecules into amino acid forms (Sapto Kuntoro, 1979). The use of bromelain is almost similar to papain and ficin. In recent years the demand for powdered bromelain has increased and most of this enzyme is used to maintain meat resistance at chilling temperatures and for drying meat. The bromelain enzyme can be extracted from pineapple stems which are called stem bromelin or can also be extracted from fruit called bromelin bras (fruit bromelain) with classification numbers EC.3.42.4 and EC.3.42.5. Both of these are obtained by extracting pineapple fruit and in the fruit juice there is the enzyme bromelain which can be used directly or if it is to be preserved, acetone can be added to precipitate it and then dried (REED, 1966).

Research on the properties of this enzyme has been carried out for some time and several data have been obtained that describe its physical and chemical properties. According to Collowic and Kaplan (1978), stem bromelain can be separated into five active proteolytic components that differ in their amino acid composition, where the terminal amino acid group is valine while the terminal part of the carboxyl group is glycine. The physical properties of the bromelain enzyme were discovered by Yamada et al in Tokong (1979) who stated that fruit bromelain is a simple protein that has a molecular weight of 31,000 with an isoelectric point at pH 4.6. With gradual degradation it was found that the terminal amino acids of fruit bromelain have the following structure:

Ala-Val-Pro-Gln-Ser-Ile-Asp-Trp-Arg-Asp-Tyr-Gly-Ala. Meanwhile, the sequence of amino acids around the active part is: Asn-Glx-Asn-Pro-Cys-Gly-Ala-Cys, where Cys is the active cysteine group. Meanwhile, stem bromelain belongs to the glycoprotein group, meaning it contains one oligosaccharide in each molecule, which is covalently linked to the polypeptide chain of the enzyme. This stem bromelain enzyme is active towards the –SH group and this group is the site of its catalytic hydrolysis activity. The sequence of amino acids around the active site can be shown as follows:

-cys-Gly-Ala-Cys-Trp

Asn-Gly-Asp-Pro-Cys-Gly-Ala-Cys-Trp

Cys shows the location of the active site (Marachi and Neurath in Collowic and Kaplan, 1978)

2.3 Soy sauce

Soy sauce is a very popular product among the public. Traditionally soy sauce is made by fermentation, namely by using microorganisms to ferment the soybeans. Now many soy sauces are made using non-fermentation methods, namely with the help of enzymes 9Sapto Kontoro, 1979).

According to goods quality standard number 25/DSNPM/78, soy sauce is defined as a food flavoring ingredient in liquid form obtained from the fermentation of soybean staples plus other ingredients (Anonimus, 1978). So based on this definition, enzymatic hydrolysis and then processing with soy sauce

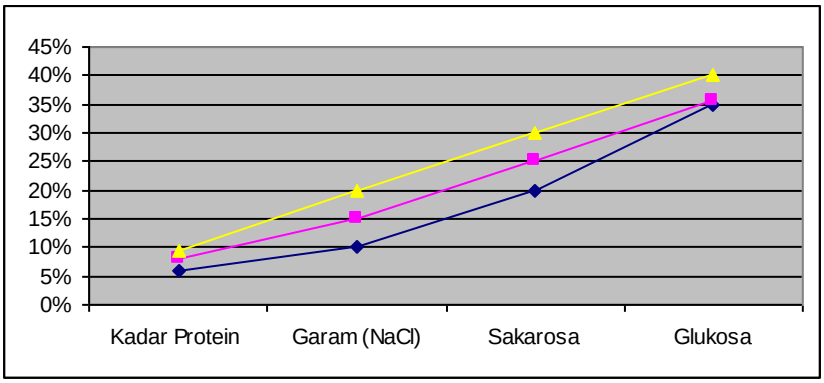
does not result in a processed product called soy sauce. But in this article the product is still referred to as soy sauce which has undergone process modifications and innovations.
The requirements specified for soy sauce still vary according to goods quality standard number 25/DSNPM/78, medium flavored soy sauce that is traded must contain a total nitrogen content of 0.48 percent or when converted into crude protein content, which is as in table 1.

Table 1. Basic requirements for the quality of rice field snails

Criterion % weight	Quality I	Quality II	Quality III
Protein Content	6 %	8 %	9.5 %
Salt (NaCl)	10 %	15 %	20 %
Saccharose	20 %	25 %	30 %
Glucose	35 %	35.5 %	40 %

Source: goods quality standard number 25/DSNPM/78

From the quality standards table above, it can be seen in graph 1.



Graph 1. Quality standards for rice field snails

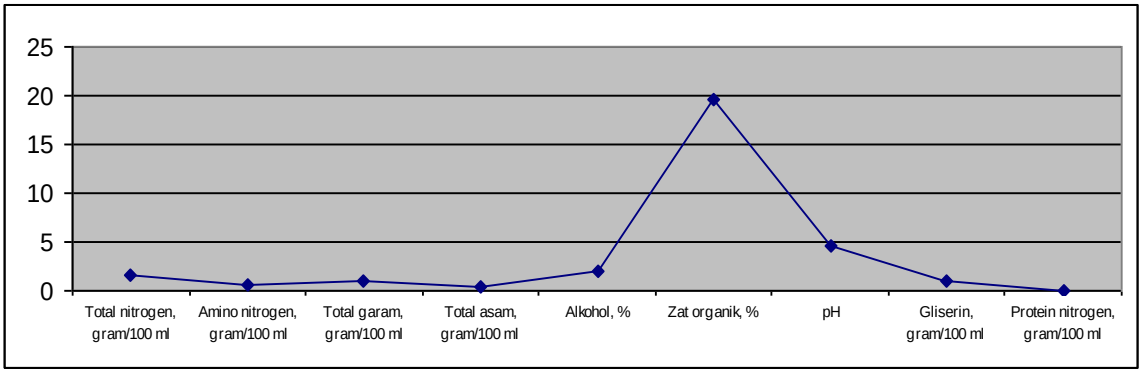
According to Yokotsuka (1960), good quality soy sauce is one that contains 1.5 grams of nitrogen per 100 ml and 18 grams of sodium chloride per 100 ml, and also contains amino acids, sugar, alcohol, glycerin and organic acids and a pH of 4.62. The composition of high quality soy sauce can be seen in table 2.

Table 2. Composition of soy sauce

Component	**Content**
Total nitrogen, grams/100 ml	1.51
Amino nitrogen, grams/100 ml	0.70
Total salt, grams/100 ml	1.06
Total acid, grams/100 ml	0.48
Alcohol, %	2.00
Organic substances, %	19.70
pH	4.62
Glycerin, grams/100 ml	1.00
Protein nitrogen, grams/100 ml	0.09

Source: Tanty Indrawati, et al 1983

From the table of composition of high quality soy sauce above, the following graph can be made



High quality soy sauce composition graph

2.4 Soy Sauce and Gelatin Seasoning Components

Seasoning is a general meaning for all ingredients that are mixed into food as flavoring, including salt, shrimp paste, sugar, vinegar, monosodium glutamate, spices and so on (Soediarto, et al., 1978).

1. Kluwak
   Kluwak is known by different names in each region in Indonesia. The Latin name is Pangium edule Reinw from the Flocouritiaceae family. Kluwak is picung that has been marinated in the ground with the aim of eliminating its poison. Kluwak is used to season vegetables such as rawon, kluwak chili sauce. In general, it is used as a savory because it contains quite high fat, namely 24%, which functions as a black color enhancer.
2. Phekak
   Pekak is known by its Indonesian name as star anise, because it is shaped like a star. Phekak greatly influences the aroma and taste of soy sauce because it has a distinctive smell. Apart from that, it is also used as a cough medicine.
3. Garlic
   Garlic comes from the Amaryllidaceae family, with the Latin name *Allium sativum* L., has a distinctive and sharp odor so it is used less than other onions. Garlic contains ferrous diallyl disulfide compounds which give garlic its odor.
4. Galangal
   Galangal is also called galangal which is usually used to flavor vegetables or as an input. The Latin name is *Alpina galanga* from the Zingiberaceae family, this plant is known throughout the country. The roots of the stick can be used as a medicine for tinea versicolor.
5. Bay leaf
   Bay leaves belong to the Myrtacea family, known by their Latin name *Eugenia polyantha* , and are used as a food flavoring because they contain essential oils.
6. Lemongrass Leaves
   Lemongrass plants originate from India and Sri Lanka. Its function is to make lemongrass oil, a herbal concoction and is used for sherbet drinks. Apart from that, it is also used to perfume Indonesian dishes, because it gives a special aroma. The Latin name is *Cymbopogon citratus* from the Poaceae family.
7. Brown Sugar and Salt
   The ingredients commonly used in cooking are salt and sugar. Brown sugar is used in making soy sauce with the aim of adding black color to the soy sauce with a distinctive aroma. Meanwhile, salt is used as a flavor enhancer, because the soy sauce that will be made is soy sauce that has a medium essence taste.
8. Coriander
   Coriander has the Latin name *Coriandrum sativum* , belonging to the Umbelliferae family. Coriander is usually used in cooking because it produces a distinctive aroma caused by the volatile substances it contains.
9. Turmeric
   Turmeric is usually used as a coloring agent or herbal medicine. In cooking, turmeric is added to give it a yellow color and also eliminates the rancid smell.
10. Vetsin

Vetsin is a food flavoring that contains monosodium glutamate. This compound provides a unique stimulation of the nerve endings of taste and strengthens and accentuates the flavor of a dish. This flavoring is quite important in making soy sauce.

11. Gelatin

Gelatin is a water-soluble protein derivative obtained from controlled hydrolysis of colagen. This collagen is a constituent of animal connective tissue protein from animals. Gelatin is a protective ingredient for food production, such as protecting vitamins and flavors. Gelatin also functions as an oxidant. Its use depends in one way or another on the properties of gelatin, which are unique and provide certain functions in its use. Gelatin acts as a stabilizer which is commonly used in making ice cream to produce smooth ice and texture by controlling the formation of crystals during melting and freezing. Gelatin usage is generally between 0.25 to 0.5 percent and can be combined with other stabilizers such as "vegetable gum" to increase its effectiveness.

3. Discussion

3.1 Fixed Costs

As is known, there are two general concepts of costs, namely fixed costs and variable costs. According to Raksohadiprodjo (2000) Fixet Costs are costs incurred by producers, individuals and/or the government for production activities. Fixed costs in the Keong Sawah Soy Sauce company are all costs incurred by Keong Sawah Soy Sauce producers in the form of production equipment procurement costs including: Pans, Buckets, Filter Cloths, Knives, Cutting Boards, Bottles, Entongs, Stoves, Frying Pans. Manufacturers of Keong Sawah Soy Sauce obtained Fixet cost data as in table 3.1.

Table 3.1. Analysis of the income of the Sawah Keong Ketchup industry.

No	Labor	Pan	Bucket	Filter Cloth	Knife	Cutting board	Bottle	Entong	Stove	Wok	Print	Finished Mold	Total
		(Rp).	(Rp).	(Rp).	(Rp).	(Rp).	(Rp).	(Rp).	(Rp).	(Rp).	(Rp).	(Rp).	(Rp).
1	4	15,000	10,000	6,000	5,000	5,000	10,000	10,000	250,000	50,000	250,000	100,000	711,000
2	6	15,000	10,000	6,000	5,000	5,000	10,000	10,000	250,000	50,000	250,000	100,000	711,000
3	8	15,000	10,000	6,000	5,000	5,000	10,000	10,000	250,000	50,000	250,000	100,000	711,000
4	10	15,000	10,000	6,000	5,000	5,000	10,000	10,000	250,000	50,000	500,000	1,000,000	1,861,000
5	12	15,000	10,000	6,000	5,000	5,000	10,000	10,000	250,000	50,000	500,000	1,000,000	1,861,000
6	14	15,000	10,000	6,000	5,000	5,000	10,000	10,000	250,000	50,000	500,000	1,000,000	1,861,000
7	16	15,000	10,000	6,000	5,000	5,000	10,000	10,000	250,000	50,000	500,000	1,000,000	1,861,000
8	18	15,000	10,000	6,000	5,000	5,000	10,000	10,000	250,000	50,000	500,000	1,000,000	1,861,000
9	20	15,000	10,000	6,000	5,000	5,000	10,000	10,000	250,000	50,000	500,000	1,000,000	1,861,000

Fixed costs per day are the total costs that must be incurred by producers of Keong Sawah Soy Sauce divided by the economic life of the production equipment.

Tools for making Rice Snail Soy Sauce

have varying economic lives as in the following table.

Table 3.2. Fixed cost per day

No	Labor	Fixed Costs	
		Total amount	FC/Day
		(Rp)	(Rp)
1	4	711,000	1,947.95
2	6	711,000	1,947.95
3	8	711,000	1,947.95
4	10	1,861,000	5,098.63
5	12	1,861,000	5,098.63
6	14	1,861,000	5,098.63
7	16	1,861,000	5,098.63
8	18	1,861,000	5,098.63
9	20	1,861,000	5,098.63

3.2 Variable Cost

The variable cost for each unit produced is known as ***"Marginal Variable Cost*** ". As is the case with " *Marginal revenue"* with the concept of variable marginal costs for each unit produced. This is caused by changes in productivity levels. Productivity is essentially a measure of how cheaply a company can produce a unit of goods. In the case of the production of snail rice sauce, productivity can simply be calculated by checking the amount of extra energy that must be utilized to increase the production of snail rice sauce. If the company owner only employs one worker, the worker must do all types of work to produce rice snails, starting from washing the snails, cleaning them, until the results are ready for consumption. It should be noted that when increasing the number of workers from 4 to 6 people, variable costs increase but the number of rice snails produced increases, therefore the cost per bottle produced (marginal variable coast) decreases. The tendency to increase productivity often occurs when companies initiate production expansion. But this is not the case if the company continues to expand production by continuing to increase the workforce employed.

The improvement in productivity (the marginal decrease in the coast variable) will continue to occur up to a point but will then experience a decline. The more workers you add, the more the cost of wages will increase, but this does not mean that the production of rice field snails will increase because every tool used has reached its production capacity. Once the production capacity of the equipment used reaches capacity, the increase in coast will be faster than the increase in the number of rice field snails produced, therefore the increase in costs for producing rice field snails will increase (increasing marginal *variable coast*). This phenomenon ultimately reduces productivity (increases MVC). From the results of a literature study on the Keong Sawah soy sauce company, variable cost data was obtained for each additional workforce as in the table below.

Table 3.3. total variable Cost for each additional workforce

Soy Sauce (Rp)	Labor (Rp)	Expert Staff (Rp)	Firewood (Rp)	Water (Rp)	Electricity (Rp)	Total (Rp)
1,150,000	500,000	500,000	140,000	40,000	25,000	1,855,000
2,120,000	100,000	500,000	160,000	42,000	20,000	2,442,000
4,130,000	1,500,000	500,000	200,000	45,000	25,000	5,900,000
5,200,000	2,000,000	500,000	220,000	50,000	25,000	7,495,000
6,110,000	2,500,000	500,000	220,000	50,000	25,000	8,905,000
6,500,000	3,000,000	500,000	220,000	50,000	25,000	9,795,000
6,600,000	3,500,000	500,000	220,000	50,000	25,000	10,395,000
7,250,000	4,100,000	500,000	220,000	50,000	25,000	11,645,000
7,700,000	4,700,000	500,000	220,000	50,000	25,000	12,695,000

3.3 Total Cost

The fixed cost portion is included in the calculation of daily production costs for the Keong Sawah soy sauce company. As long as total *revenue* does not exceed fixed costs, the profile will be negative and the company is at risk of bankruptcy or closure. The total *fixed costs* for the Keong Sawah soy sauce company will be obtained by adding up *the fixed costs* / day plus the variable costs per day. From the analysis results, total cost/day data is obtained as in the following table.

Table 3.4. Total cost

No	Labor	*Fixed Costs*	Variable Cost	Total Cost
1	4	1,947.95	1,355,000	1,855,000
2	6	1,947.95	1,942,000	2,442,000
3	8	1,947.95	5,400,000	5,900,000
4	10	5,098.63	6,995,000	7,495,000
5	12	5,098.63	8,405,000	8,905,000
6	14	5,098.63	9,295,000	9,795,000
7	16	5,098.63	9,895,000	10,395,000
8	18	5,098.63	11,145,000	11,645,000
9	20	5,098.63	12,195,000	12,695,000

3.4 Data analysis

Because of the assumption of a fixed quantity of a mineral resource, Gray reasons that the cost of extraction (usually analyzed based on the concept of " *marginal cost* " i.e. the cost per unit of each additional output) will include an additional element. He developed a concept known as " *user cost* ", with the idea that the possibility of using a non-renewable resource in the future will be sacrificed if a certain amount of the stock of the resource in question is exploited and used today. The production of goods itself is not the final goal of the producer, but the production in question allows the producer to carry out an exchange process with money to generate income. However, the production of an item of goods is not a job without costs. Producers must purchase resources (raw materials, labor, and so on). Producers must guarantee that the amount of money that must be received to produce an item (*firm's revenue*) exceeds costs so that profits can be obtained. In relation to the concept of profit, a distinction must be made between the concepts of *revenue* and *costs* . In the case of a manufacturer who produces Keong Paddy Soy Sauce, for example, the revenue obtained from the sale of one bottle of Keong Paddy Soy Sauce will be largely determined by the market price of the goods in question. The market price will be determined by how many consumers need it and how many producers overall produce the snail rice sauce in question. These factors are generally beyond the control of individual producers and consumers. It is necessary to understand the concept of marginal amounts again. The marginal amount relates to a single *unit* . So marginal revenue is the amount of revenue received by the company from selling one unit of output. So marginal revenue will be the same for all units of output sold. The marginal revenue from the first bottle of Snail Rice Soy Sauce will be the same as the 1000th bottle of Snail Rice Soy Sauce. Marginal *revenue* (extra revenue obtained from each additional unit produced) will remain the same as production increases. Meanwhile, *total revenue* will increase with increased production. Since the producer receives the same amount of money for the sale of the first bottle as for the sale of the 10,000th bottle, say that the producer has a constant *marginal revenue* . Meanwhile, *total revenue* will be obtained by multiplying *marginal revenue* by the number of bottles sold. From the data above, the analysis results are obtained as in the table below.

Table 3.5. Total Profit Analysis Table

Data analysis						
Output/hr (bottle)	**Outpout/org (bottle)**	**MVC (Rp)**	**MR (Rp)**	**TR (Rp)**	**MNPB (Rp)**	**Total Profit (Rp)**
200	40.2	20,775.00	50,000	3,120,000	1,100.77	3,192,115.97
250	40.5	20.7	50,000	5,200,000	2,201.10	5,252,512.30
350	42.55	14.8	50,000	7,700,000	3,266.90	7,753,674.25
375	40	21,700.07	50,000	10,200,000	319,550	10,591,665.07
400	37.17	21,802.30	50,000	11,650,000	2,755.85	11,724,995.32
450	35	22,133.04	50,000	12,200,000	2,003.58	12,274,621.62
500	30	22885.3	50,000	13,765,000	1,426.39	13,839,841.69
550	28.5	23,472.41	50,000	14,400,000	913.25	14,474,964.16
600	25.73	24,076.74	50,000	15,000,000	450.2	15,075,152.67

3.4.1 Interaction If There Are Environmental Improvement Costs

Companies usually take into account two factors in determining the level of output that must be produced in a free market, namely:

1. How many units of output can be sold
2. How much does it cost to produce each unit of output

It is understood that the costs required to produce each unit of output successively (*marginal variable cost*) ultimately increase along with the expansion of the number of output units produced. It should be noted that the company will only increase the amount of output when the price received from each extra output (snail rice sauce) produced exceeds the cost of the extra resources used. This means that the company will be very

careful in using resources if it has to pay for the resources in question. The important conclusion is that the free market provides a strong incentive for companies to conserve resources rather than exploit them if those resources have to be paid for.

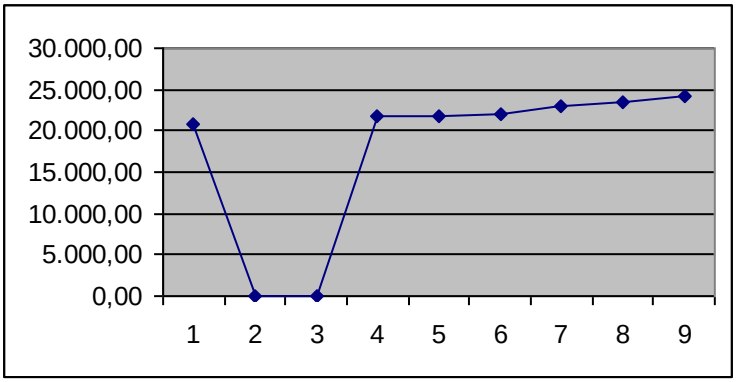
Companies will only use resources up to the point where the cost (*marginal*) is equal to the revenue (*marginal*) they produce, and will not use them (*overused*) beyond that point. The understanding above shows that the free market actually determines the efficiency of resource use. However, the problem will be different if we understand that there are a number of environmental resources that are not actually valued/valued in money (*free of charge*) by the market. Therefore, the costs faced by companies making snail rice sauce if they increase energy use (electricity) and dispose of production waste do not at all reflect additional environmental damage. In reality, environmental damage must be accepted by many communities *in* the form of a decline in the level of health, environmental health and so on. In internalizing environmental improvement costs, the Keong Sawah soy sauce company realizes environmental improvements in the form of creating a place for waste disposal. From the data above, analysis results can be obtained as in the table below.

Table 3. 6 Environmental MNPB

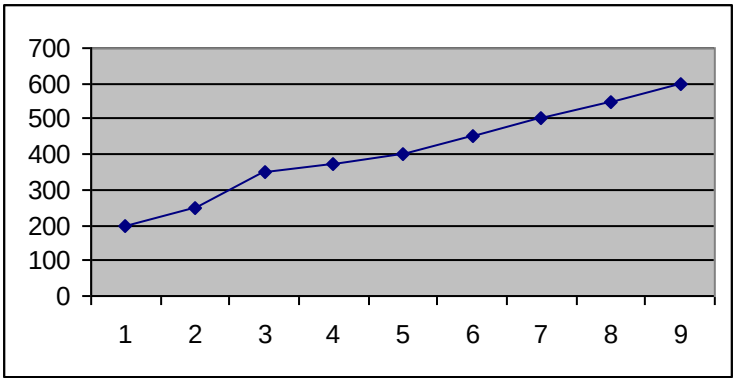
No	MNPB Analysis of Environmental Improvement						
	Labor (people)	**Output/hr (bottle)**	**MVC**	**MVC Links**	**MR**	**MNPB**	**T.P**
1	4	200	20,775.00	20. 775.00	50,000	1,100.77	92,854.77
2	6	250	20.7	20.7	50,000	2,201.10	52,498.50
3	8	350	14.8	14.8	50,000	3,266.90	53,654.50
4	10	375	21,700.07	21,700.07	50,000	319,550	413,335.14
5	12	400	21,802.30	21,802.30	50,000	2,755.85	96,772.45
6	14	450	22,133.04	22,133.04	50,000	2,003.58	96,733.66
7	16	500	22885.3	22885.3	50,000	1,426.39	97,712.99
8	18	550	23,472.41	23,472.41	50,000	913.25	98,426.07
9	20	600	24,076.74	24,076.74	50,000	450.2	99,223.68

From the results of the analysis above, a graph of the Marginal Cost variable can be obtained, in graph 1, changes in production for each change in the number of workers in graph 2, and Marginal Net Private Benefit as in graph 3 below.

Graph 1. Marginal Variable Cost Graph



Graph 2. Production Results Graph for 9 Companies



Graph 3. Marginal Net Private Benefit

4. Conclusion

From the analysis of literature study data on 9 companies, it can be concluded as follows:

1. The treatment factor of the bromelain enzyme source influences the pH, protein content, viscosity (objective) of aroma and viscosity (organoleptic) of snail rice sauce.
2. The addition of gelatin affects the pH, protein content and taste of snail rice sauce.
3. The highest protein content is 6.0 percent which is obtained from the enzyme bromelain from pineapple flesh and the addition of 0.1% gelatin, which has a quite favorable taste, aroma, color and viscosity.
4. The highest score for the preferred taste of soy sauce was obtained by treating the bromelain source from pineapple flesh and adding 0.1% gelatin.

5. Suggestion

1. Further research needs to be conducted regarding the relationship between soaking time for rice snails and grated pineapple to determine the maximum protein hydrolysis.
2. The taste, aroma and color of snail rice sauce are greatly influenced by the spices added. Therefore, it is necessary to research the components of spices and the composition of good spices.
3. It is necessary to develop rice snail cultivation and it is necessary to provide a plot of land specifically for cultivating rice snails as a basic ingredient for rice snail sauce.
4. It is necessary to conduct research on the durability of snail rice sauce during storage.

6. References

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