Bioeconomy, Bioentrepreneurship, and Bioresources (Bio-ER) of Fermented Foods to Build Food and Health in Indonesia

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Abstract. Indonesia is the second rank country with a high biodiversity. Yet, the potential of biodiversities are underutilized, less involved in food security/sovereignty even for public health management. Generally, health is maintained through high quality and diverse food compositions either providing nutrients or bioactive phytochemicals, named functional foods or nutraceuticals. Meanwhile, a concept of bioeconomy, bioentrepreneurship and bioresources (Bio-ER) for fermented foods offers a holistic way out to build food and health simultaneously. Together with epigenetic sciences and the experience of pandemic covid-19, it has revealed a genetic regulation in the cells to cope the health status high where bioactive compounds in the various plants are capable of communicating with genome materials to switch -on or -off the health regulator key genes of the human body. This article is a review on fermented foods which is used to set up an example of peda fish Bio-ER system to supply both nutritious provisions and bioactive phytochemicals maintaining healthy status intended to decrease the economic burdens in the health management such as BPJS insurance. Selected fermented foods are recommended in the future reducing economic burden, e.g., peda fish trading equal to costs of preventing catastrophic disease maximum 1.5 million people benefitting functionality.

1 Introduction

Indonesia is the second largest country with a highly diverse biodiversity. There are 670 species of mammalian, 1711 species of birds, 4782 species of fishes, 1600 species of crustaceans, 1120 species of reptiles and amphibians, and 29375 species of vascular plants comprised of 1500 algae, 595 lichens, 2197 Pteridophyta, 40000 seeded plants, and 80,000 sporangium plants according to Indonesian Ministry of Forest and Environment in 2024. With the knowledge of bioactive compounds affecting health quality and the sustainability of all the biodiversity species, it can be considered that exploration of all potentials of bioresources is supportive for FAO's motto of "no one left behind", meaning that Indonesia

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has a huge capacity to build high quality foods and a health service system. However, the biodiversity tends to decrease by 69% [1].

For the sake of sustainable biodiversity then a concept of bioeconomy is campaigned. By giving the preposition of "bio-" it is expected that industries and humans are aware of the facts their living are dealing with the biological matters. The extinction of the biodiversity would threaten the living itself. According to Bioeconomy Summit 2015, bioeconomy is defined as knowledge of biological resources, processes, and principles to sustain service all economic sectors for better and healthy living. The bioeconomy activities include utilization, enabling and converging technology, and integration across application including all living natural resources, industry, and health care [2]. Currently, bioeconomy which introduced in about 1971 by Nicholas Georgescu-Roegen has been accompanied with bioentrepreneurship and bioresources. Bioresources deals with all living nature. Meanwhile, bioentrepreneurship integrates life science (biology) and entrepreneurship, which requires skills in positive energy, leadership quality, appropriate track record, technical knowledge of the field, articulating and managerial skills. The roles of bioentrepreneur cover up activities on biological materials for effective utilization, improve income, employment, conservation, life quality, infrastructure, technology and export [2].

Even though many genetically modified organisms are created and indeed scarce data information of how many species used by human, the biodiversity tends to decline. It warrants other efforts to link the ethnobotany of the species in order to be maintained by humans. Therefore, implementing bioeconomy in a holistic approach could help sustainability of the biodiversity through the utility by humans as the actors (bioentrepreneur) with particular skills in managing the biological resources as the objects (bioresources).

The planning of bioeconomy construct in this paper aims to lever potential of bioresources to build a strong food and health security/sovereignty, in the view of welfare and public health. The enabler of this is the human resource capacity. The government of any country is responsible for developing the society/citizen in order to get better living or proper lives. Foods and health are the main concern where sufficient foods both in quantity and quality for their citizens of any age groups to be healthy and properly living expressed as daily intakes. Recently, efforts to achieve sustainability of a food system is implementing a circular economy which can be merged into the bioeconomy concept [3] thus waste utilization such as colorful peels of fruits/leaves, etc. could be used for bioactive compound sources supporting functional food ingredients or nutraceutical preparations. Then it generates a zero waste concept in food processing, including in agriculture, to support green agricultural practices. Moreover, the increasing acceptances of fermented traditional foods in the current diets due to its diverse health benefits from various commodities which are usually produced at micro and small scale need improving for better health assurance regarding their wide ranges of risks, i.e., lack of regulations, poor protection from pathogenic contaminations and recontamination during processing and supply chain, and technological monitoring techniques [3-4]. Hence, a circular bioeconomy of fermented foods is supported well by Sarma et al. [3] and even more precision fermentation technologies [5].

In Indonesia, the health system and welfare is managed by a system called Badan Penyelenggara Jaminan Sosial (BPJS). Problems of the welfare achievement in Indonesia is a high economic burden but it has not been interconnecting to the aforementioned high rank of biodiversity potentials; on the contrary, this high biodiversity is getting extinct. Therefore, in the organization of Indonesian Society of Functional Foods and Nutraceuticals (ISFFN/P3FNI), the efforts to build public health using local bioresources for functional foods and nutraceuticals were set up since 2017, documented into a strategic plans of the organization and is continued in the second congress the latest strategic plan 2023-2026. The under laid premise for this is that the proper utilization of local bioresources supported with

the right human resource capacity put the food and health management into a sustainable food system bioeconomy, the high BPJS's economic burden could be reduced.

The paper study the premise to what extent a unity of bioeconomy, bioentrepreneur, and bioresources provide nutritious and functional foods or nutraceutical, especially those based on the common traditional fermented foods in daily uses by the society, so the cost of public health can be lowering. A supporting theory is obtained from a lesson learnt from pandemic covid-19 which set a new insight on pathogenesis of cellular regulation under epigenetic point of view displayed in Fig. 1 (Method section).

2 Methods

A literature review using secondary data set which are furtherly explored for preventing or controlling the diabetes mellitus and/or malnutrition based on [**6**] which is combined with data information of catastrophic diseases. One of establishments to evaluate pricing economic burden is peda fish. Peda fish is a traditional fermented fish from Indonesia which is recently found containing biopeptide metabolites as bioactive compounds for health, probiotics, easily digested protein, vitamin, minerals, and lipids.

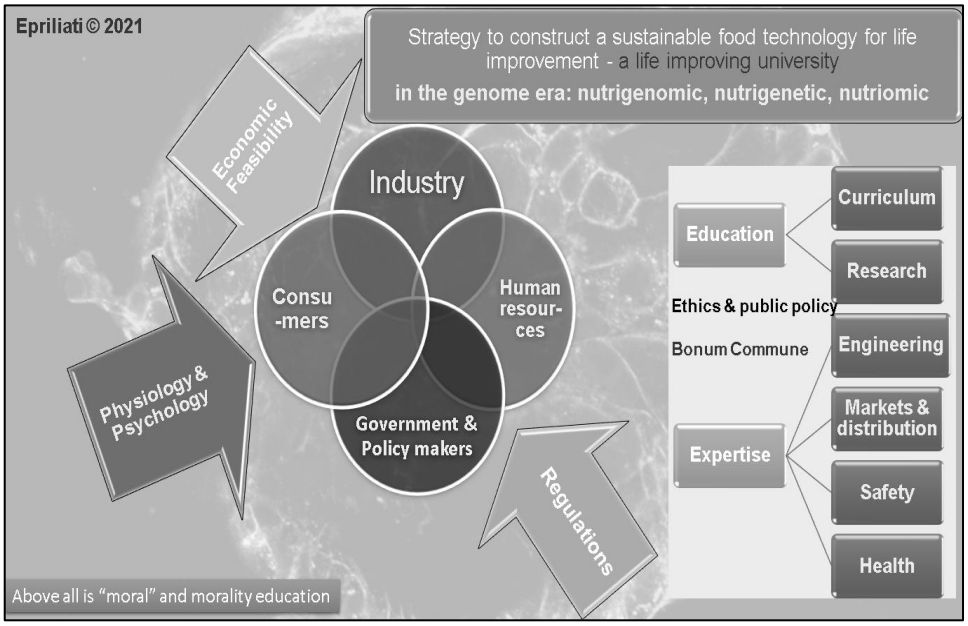

Fig. 1. Scheme of science based genetic material to build a strategic frame work [**7**]

Scientific frame work supports where the method is laid on can be explained in Fig. 1. Education on food science and technology together with the professional organization ISFFN/P3FNI provide a curriculum and research on the core of genomic based sciences such as nutrigenomic, nutrigenetic, nutriomic, including metabolomic under the light of epigenetic which explains what precisely is going on inside the human genome interactions with bioactive compounds to affecting human health status. Meanwhile, orchestra of stakeholders such as government, professional human resources in the fields, industries, and consumers in implementing consumption behaviors, where ISFFN/P3FNI can host for round table discussions/dialogues all together bring the movement of healthy consumption to prevent the disease onsets. As tools to hold and direct the orchestrated stakeholders include investigation

of economic feasibility, physiological and psychological applied sciences, and regulations from government and the related authoritative bodies such as Food and Drug Administration Body/Agent. The executive body of the frame work in Indonesia is BPJS. Therefore, investigation of the selected products of fermented foods' functionality in the human body compared to the pricing products when the cost is used to cure/treat patients with castatrophic diseases are set. Hence, the experties involved/required cover up engineers in healthy food engineering, professionals of marketing and distribution to make sure the society understand how to handle the healthy food products during distribution and in the markets, as well as food safety professionals and health care/workers to monitor society health status.

2.1 Literature Review

Literature review was obtained from a book chapter by Olatidoye et al. 2024 [8] using original articles or review papers in any years until June 2022 in data base of PubMed, Google Scholars, and Scopus. The main keywords are "plant food derivative bioactive components", "fermented foods, fermented beverages, functional foods, malnutrition, diabetes mellitus which is published as a book chapter based on meta-analysis, i.e., to compile and draw a lesson learnt from the big data information after deciphering, selecting, reviewing, and extracting the key logical relationships amongst the findings and critical thinking proposed by the researchers, research groups". The search results are manually selected, reviewed, and justified by the author team. This book chapter intended to explore the future trends and pillars of preventing disease onsets in modernization of human living. Malnutrition and diabetes mellitus are the key roots of metabolic related health problems which can develop other complicated diseases when proper nutrition and metabolisms go wrong.

2.2 Analysing financial data of catastrophic diseases from BPJS data base

Using financial performance of BPJS Insurance data base and analysing the potential of catastrophic disease to be prevented from occurring or controlling through dietetic management. This means the activities are match-making disease descriptions, especially the onset mechanisms or curative treatments or preventive actions of the diseases; and the disease treatment costs from Data BPJS is obtained from infographic about "Indonesia Baik" website under Ministry of Communication and Information Republic of Indonesia [9]. The found matched factors are used to synthesize knowledge on fermented foods' potentials to building the public health through their consumption (dietetics) and effective reduction of economic burdens of disease treatment costs is proposed. Justification is based on BPJS cost per unit treatment per individual disease prevalence expressed in IDR/disease.

2.3 Devising work business of bioeconomy, bioentrepreneurship, and bioresources for peda fish

An example of work business set up of bioeconomy, bioentrepreneurship, and bioresource organization in a circular economy is constructed for peda fish. Its processing steps are shown in Fig. 2.

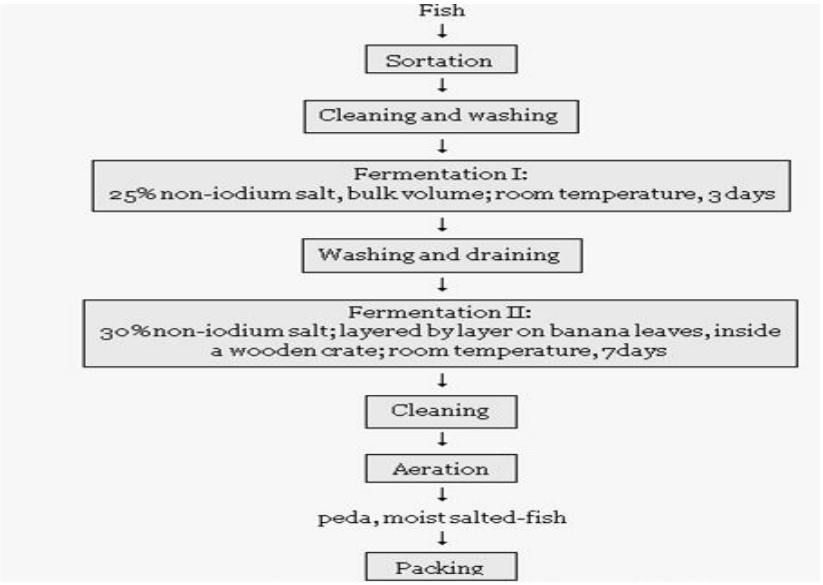

Fig. 2. Peda fish processing [**10**]

Its industrialization is categorized into micro- and small- scale food entrepreneurs which untouched by the top national managements, including BPJS. The most critical concern is ethics/moral thus bioeconomy is truly built the foods and health for all (no one left behind) where commoners could afford for their daily menus. When it is intended to implement bioeconomy, bioentrepreneurship, and bioresources therefore all relevant sides and each roles and scopes are mapped and peda fish technical production should be devised; then they are constructed into a new paradigm to involve in the orchestrated frame work components in Fig. 1. Questions for work business plan and technological design are listed below.

1. What is the importance of industrialization of fermented food and beverage in Indonesia in the era of increasing health awareness?
2. What food security pillars are peda fish playing?
3. What health security roles are peda fish contributing so economic burden being affected significantly?
4. What are critical problems currently faced when putting peda fish as part of food and health improvement in Indonesia?
5. What are precise technology required (scientifically sound) to improve peda fish processing to guarantee the proper dosages of important specific bioactive compounds for malnutrition and diabetic diet as part of preventing program?
6. What are regulations to drive a massive society consumption of peda fish for their foods and health maintenance?
7. What human resources are required for sustainable peda fish safety and quality?
8. What are economic feasibility of peda fish industrialization implemented 1-7 recommendation?

3 Results and Discussion

Table 1-5 show the logical flow of the method 1-3 in generating information to achieve the goals of the paper. The ‘controlled diets’ in the tables indicates unavailable literatures

Table 1. Several fermented foods and its information on uses, food and health related epigenetic signaling and whether it involves in prevention or controlling diseases [6].

No.	Fermented foods	Uses	Provisions	Epigenetic signaling	Diet related prevention/controlling?
1	Velvet bean tempe	Dishes	L-DOPA, bioactive peptides, iron, vitamin B_1	L-DOPA motoric signaling, peptides inhibits angiotensin converting enzyme	Yes Diabetes mellitus, neural, nutrition
2	Soy tempe	Dishes	Phytoestrogens, isoflavones, simple protein, vitamin B_{12}	Isoflavone factor II as esterogen replacement hormones	Yes Heart diseases
3	Fermented tubers	Bakery Ingredient	Dietary fiber/ resistant starch, antioxidants	n.a	Yes Hypothetic metagenomics, Dietary fiber related diseases, colon cancer
4	Fermented vegetables	Dishes	Lactic acids, short chain fatty acids	Gene expression related to metabolism & immunity, body weight control	Yes Obesity
5	Red yeast rice	Colorant	Citrinin	Inhibiting mouse oocyte maturation and embryo development through cytoskeletal dynamic obstruction, may be due to oxidative stress thus inducing early apoptosis [**11**]	Yes Diabetes mellitus
6	Liquid extracts of fermented tuber/rice	Beverages Snacks	Metabolites	Body weight control, bioactive exopolysaccharides	Yes Heart diseases
7	Fermented ocara (tempe gembus)	Dishes	Dietary fiber, metabolites	n.a	Yes Dietary fiber related diseases

No.	Fermented foods	Uses	Provisions	Epigenetic signaling	Diet related prevention/controlling?
8	Fermented rice bran	Functional food ingredients	Dietary fiber, mineral, γ–amino butyric acid	Alleviating effects of oxidative stress N-diethyl nitrosamine, reducing degree of methylation glutathione-S-transferase P1; anti inflammation adaptive pattern with lower telomere length ratio & changes in long interspersed nuclear element-1 methylation [12]	Yes Degenerative diseases, intervention during inflammation (diet)
9	Fermented tea	Polyphenols, flavonoids	Antioxidants, metabolites	Anti-hyperglycemia, alleviate hepatic toxicity index, decreasing aspartate transaminase & γ-glutamyl transpeptidase,	Yes Hyperglycemia
10	Fermented fish		Probiotics, minerals, high EPA and DHA, antioxidants, essential nutrients, bioactive peptides, ascorbic acid [13]	n.a but initial activities of increasing IgM using human-human hybridoma HB4C5 cells from heat stable soluble protein [14]	Yes Health promoter through immunomodulatory, Antihypertension antithrombotic, antimicrobial, anticancer [13]

n.a. = not available

Table 2. Data of catastrophic diseases and their costs spent by BPJS in 2022; and further calculated cost for each case, and literature information on diet related prevention or controlling prevalence [9]

Ranks	Catastrophic Diseases	Cases	Cost (Billion IDR)	Cost/case (Million IDR)	Diet Related prevention/control?
1	Hemophilia	116,767	650	5.567	Yes High iron diets/phytochemical platelet activity
2	Leukemia	146,162	429	2.935	No -
3	Thalassemia	305.,265	615	2.015	Yes Controlled iron intake
4	Hepatic Cirrhosis	193,989	330	1.701	Yes Alcohol, hepatitis infection
5	Kidney Failure	1,322,798	2,156	1.630	Yes Controlled diet
6	Cancer	3,147,895	4,501	1.430	Yes Healthy life style
7	Stroke	2,536,620	3,235	1.275	Yes Healthy life style
8	Heart disease	15,495,666	12,144	0.784	Yes Controlled diet
	Total costs		**24,060**	**17.337**	

Table 3. Information of epigenetic nature of catastrophic diseases and their pathogenesis routes

Catastrophic diseases	Epigenetic nature	Pathogenicity routes
Hemophilia [15-16] (poor blood clot ability)	Inherited X-gene linked hemostasis disorder	Defective fibrin which inhibits fibrin formation and finally causes secondary hemostasis failures
Leukemia [17] (blood cancer)	Multiple genetic and environments	Transformation of malignant increasing myeloid and lymphoid precursors of hematopoietic stem cells
Thalassemia [18] (red blood cell formation failure)	Inherited hemoglobin disorder	Gene mutation, modified □-globin gene, excessive □ –globin, disease
Hepatic Cirrhosis [19] (liver cancer)	Hepatitis viral infection, heredity conditions, toxin, autoimmune processes	Hepatocytes and sinusoidal lining cells releasing harmful mediators, e.g., reactive oxygen species and inflammatory mediators
Kidney Failure [20]	Diabetes mellitus, hypertension, glomerulonephritis, tubulointerstitial nephritis, heredity, cystic diseases	Extrinsic inflammation cells infiltration, loss of intrinsic renal cells, depositing extracellular matrix producing cells
Cancer [21]	Heredity and environment (radical oxygen species, radiation, viral infection, life styles)	Clonally indicates accumulation of multi abnormalities for many years
Stroke [22] (blood vessel bleeding)	Hypertension, diabetes mellitus	Lipohyalinosis of small vessel, the lumen occluded, thin walls shredded involving hemosiderin-filled macrophages due to embolic mechanism; thromboembolism
Heart disease [23]	Heart and circulatory system disorders, atherosclerosis, arterial hypertension	Matrix metalloproteinases and immune system dysfunctions; endothelial dysfunction, genetic backgrounds

or the literature referres to a complex regulation onset for each catastrophic disease. Meanwhile, the ‘signaling’ in epigenetics indicates cross talks or interactions of the active substances with DNA therefore it is switched on- or off- through DNA methylation and histone modification mechanisms. Table 1 lists potential fermented foods with its capabilities to prevent or control diseases through diets.

A catastrophic disease is a type of disease which requires long term care and very expensive cost to care; these diseases are very high risks to cause death. Table 2-3 tabulates characteristics of those catastrophic diseases regarding each nature based on epigenetics sciences and disease onset/pathogenicity and indicative for prenvention or control by diets. Thus, fermented foods obviously bring opportunities to prevent/control catasthropihic diseases and they are supported with scientific proofs.

The logical flows of method analysis to dig the implementation of bioeconomy in line with bioentrepreneurship and bioresources has been displayed above. From Table 1 we can see that epigenetic based sciences for management human health is available, yet it is only for few Indonesian fermented foods. And Table 2 tells us that catastrophic diseases which are responsible for economic burden in BPJS, scientifically are supported by research findings on their epigenetics and pathogenesis routes. Based on these economic burden of the health cares, the potential of peda fish will provide beneficial protein intakes as well as relating to potential of diet component for health management. It can be seen that the

individual case of hemophilia is the highest but heart diseases is the lowest. However, the inherited catastrophic diseases still can be affected by the interaction based on epigenetic mechanism. Hence, we need to explore potential fermented foods (Table 4) for improving the health care system in Indonesia which reduces the economic burden. All those selected fermented foods are affordable in common society.

Table 4. Recommended fermented foods to build food and health in Indonesia [3]

Fermented foods	**Raw materials**	**Building Indonesian Food System through Bio-ER**	**Building Indonesian Health**
Growol	Cassava	Staple foods containing Lactic acid bacteria	Lactic acid bacteria (probiotics & metabolites)
Peda	Fish	Salty cooked – dried fish containing active peptides	Biopeptide metabolites, probiotics; easy protein digestion, vitamin, minerals, lipids
Tempe	Legumes	a. Simple protein provision & bioactive compounds	Healthy plant based proteins Bioactive metabolites
		b. Simple protein, vitamin B_{12}, a source of L-DOPA & kasugamycin	Neural related chronic diabetes mellitus
Red Yeast Rice	Rice	Additive coloran with active metabolites	Cholesterol/diabetes mellitus control
Kimchi	Chinese cabbage	Dishes	Body weight control, reductions in serum total cholesterol, triglycerides, low-density lipoprotein cholesterol levels & atherogenic index
Kombucha tea	Fungi, tea extracts	Beverages	Reducing blood glycaemia, oxidative stress, diabetes-induced weight, chemically-induced nephrotoxicity, hypercholesterolaemia & indomethacin-induced gastric ulceration
Kefir	Milk	Beverages	Body weight control, improving protein digestibility, lowering flatulence, abdominal pain, diarrhea, treatment for *H. pylori* infections & preventing antibiotic-associated diarrhoea

Mind mapping of bioeconomy, bioentrepreneurship characteristics of human resources required, and bioresources to sustainability of fishery ecosystem when peda fish industry is being promoted nationally for building food and health in Indonesia is shown in Table 5.

Table 5. Mapping of bioeconomy, bioentrepreneurship, and bioresources implemented for a case study of peda fish industrialization for food and health (question #1-7, Subsection 2.3)

No	Parameters	Implementation for peda fish as healthy food sources
Bioeconomy		
1	Production activity related to life sciences to earn profits	
	a. Biological entities	Indian Mackerel (Rastrellinger sp.)
	b. Idea	Diet component for preventing/capita selecta malnutrition or diabetes mellitus
	c. Utilization activity	Foods (functional foods) or supplement (nutraceuticals)
2	Conservation activity and regeneration of biological resources activity to provide sustainable solutions	
	a. Knowledge, science, technology, and innovation (information, products, processes, and services)	Reproduction behavior of Indian Mackerel (Rastrellinger sp.), breeding technology, safe cultivation either natural environment or modified in the sea (e.g. underwater "apartment" cultivation)
	b. Within and across all economic sectors	Regulation by government, research institution, education and training from expert in the field, fishermen community watch, consumers' consumption pattern
	c. Enabling transformation to a sustainable economy	Strategic plan under legal authority
Bioentrepreneurship		
1	Idea	Environmental awareness of industrialization actors
2	Invention	Specification of fermenter equipped with digital monitoring for critical fermentation parameters (e.g., temperature fluctuation, prime time of metabolites/colony numbers of Lactic Acid Bacteria, identification of mixed cultures)
3	Asset of activities to create an environment and infrastructure for well-trained professionals to build research-based projects and their commercialization	Budget allocation for natural environment of Indian mackerel preservation, monitoring and data log control of innovation in cultivation, teaching youth on Indian mackerel conservation & regeneration, implementation of environmentally friendly commercialization through continuation education especially for fishermen's family/society.
4	Required skills	
	a. Positive energy	Earning profit for better world to live for all
	b. Leadership qualities	Experts in maritime field, integrity to serve community, respecting living for others morality
	c. Appropriate track records	Experiential track records in maritime field
	d. Technical knowledge of the field	Experiential track records in maritime and engineering

No	Parameters	Implementation for peda fish as healthy food sources
	e. Articulating	Communication skill with other sides relevant stakes holders especially different expertise or fields
	f. Managerial	General
Bioresources		
1	Life sciences	A comprehensive Indian mackerel life cycle

On the otherhand, economic feasibility (question #8 Subsection 2.3) of food plant design is acknowledged that facilities for production is unnecessarily sophisticated like chemical engineering based plant design, as many fishermen have done at home scale industry [**24**]. In Indonesia market place rate of peda fish reaches 62,923 IDR plus 18,000 IDR for delivery fee in Central Jakarta City and to the most high delivery cost in the archipelago in Eastern Indonesia reaches 149,000 IDR, fortunately, many Indonesian areas are coastal area and sea fishes are available at minimum processing involvement. One of governmental channel in Malang City, East Java, selling peda dishes ready to eat at cost of 22,000 IDR/300 g and 50,000 IDR/400 g where a comprehensive specification and dialogues with customer's review show rating 4.9 of 5 score, 526 followers, indicating a good acceptance by consumers. This is an illustration of peda fish keeping up with current trend of trading. Meanwhile, the price of raw Indian mackerel on the market place ranges from 22,000 – 61,600 IDR/kg from various cities in Indonesia. However, there is rare information of peda fish producer in Indonesia despite many traditional markets mostly have seller of peda fish in the same seller for vegetables.

The average economic burden spent by BPJS per case (2.167 Million IDR) can provide healthy foods (functional or nutraceutical) for around 10^6 people and for 100 consumptions with portion of 100 g per serving three meal times per day.

Calculating the average catastrophic diseases cost by BPJS but spending it for peda fish instead, which gives edible portion of 60% w/w; it can provide provision of functionality of peda fish for health :

1. total cost of catastrophic diseases : 17.337 Million IDR
2. number of catastrophic diseases : 8
3. average peda fish price : 41.800 IDR/kg
4. edible peda fish meal containing health benefits : 31.1 kg
5. peda fish portion of 100 g per serving : 311 servings
6. number of consumption 3 meals per day : ≈100 days or 100 people
7. (or) number of people with once meal per day : 311

Thus, for total spending 24.060 trillions IDR equal to 3,453,588,516 servings or people with once serving meal per day or 1,151,196 people with three times meal per day. The chances of health booster of peda fish, at least for immunomodulatory which protects human from infections it can be considered as around 1-3 million people are saved. This warrants research on peda fish recommended daily intake to maintain public health.

Economic burden of setting up the bioeconomy in line with bioentrepreneurship, and bioresource system for particular species/commodity is based on frequencies of activities, investment of the education/training/expertise building, and feasibility of processing unit of peda fish. It gives analytical results that education investment would cover implementation of bioentrepreneuship and bioresources through human capacity building more than physical building in order to sustain it from generation to generation. It is the most critical budgeting on education in Indonesia to be capable of levering up the human resources quality.

Meanwhile, integrity and morality are part of long life education since family level to create a critical mass of "good personality" of the society. Hence, the organization of ISFFN/P3FNI contributes partial human resources capacity building for Indonesian public health as well as functional food and nutraceutical products.

The preventing program by local fermented foods would highly recommend way out to reduce economic burden in BPJS, scientifically supported and sosio-culturally being practiced by the society in Indonesia. Even, like tempe which has been being an Indonesian heritage for global society acknowledged by UNESCO. Would it be the same with other type of tempe? At least, mucuna/velvet bean tempe has been proven having capacity for healthy foods or nutraceutical forms due to its L-DOPA as a well-known golden cure of Parkinson's disease in the form of mucuna powder capsules. More fermented food inherited from our ancestors in Indonesia from 1000 tribes/ethnicity remain to be elucidated and set into a well-established program, for instance, organizing by ISFFN/P3FNI, with a tagline of "From Indonesia for health" (www.p3fni.org/). With membership including academicians, industry both as individuals or institutions, students, researchers, and all sides having concerns to foods and health; the ISFFN/P3FNI makes the strategic plan working and contributing in building Indonesian foods and health at affordable cost. These also in agreement with the history of food studies such as Mediterranean diet and other ethnic foods which is considered healthier compared to western diet.

4 Conclusion

Based on the review and devising bioeconomy, biointerpreneur, and bioresources in a unity, it can be seen that the study of economic burden through consumption of fermented foods potential affecting epigenetic and pathogenesis of diseases. A unity of bioeconomy, bioentrepreneurship, and bioresources management for sustainable food and health system can be achieved. Following are the recommendation aspects to build food and health by utilization of fermented foods. A set of tool (technological aspects) to guarantee precise fermentative metabolism in order to provide specific functional / nutraceutical metabolites or releasing them for more accessible for bioavailability in the human body is important. To do so, food technologists contribute for strains strategic for the achievement of providing bioactive compounds during fermentation, the specific processing conditions during the whole step of fermentation process to obtain a precise fermentation technology, in pack fermentation step which gives the best timing of the product quality reaching the consumers by which precise technology acts as the back bone sci-tech to make it correct, especially those fermentation products with high economic value for export. Hence, the bioentrepreneurship involving producers (entrepreneurs), academicians, and engineering capacity to create a machine/tools with precise controller is important. Finally, the regulation to safe society from irresponsible pricing of the products by governments and their international coordination, e.g., world trade organization would, ideally, put the better living for all on earth as expected (it is called the bioeconomy concept). Overall, in order bioeconomy and bioentrepreneurship to be sustainable it needs a holistic consideration from time to time, for each case tackled. Therefore, a priority on the sustainable bioresources for future generation is a must, regulated in the food and health development. Extinction of biodiversity/bioresources can be an alarm for all that the threats are emerging, sooner or later.

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