

Faqih, Achmad; Elizabeth, Roosganda; Azahari, Delima Hasri

## Article

The increasing of competitiveness of agro-industry products through institutional empowerment to support the achievement of sustainable agricultural development

International Journal of Energy Economics and Policy

## Provided in Cooperation with:

International Journal of Energy Economics and Policy (IJEEP)

*Reference:* Faqih, Achmad/Elizabeth, Roosganda et. al. (2020). The increasing of competitiveness of agro-industry products through institutional empowerment to support the achievement of sustainable agricultural development. In: International Journal of Energy Economics and Policy 10 (5), S. 663 - 671.

<https://www.econjournals.com/index.php/ijEEP/article/download/10376/5333>.

doi:10.32479/ijEEP.10376.

This Version is available at:

<http://hdl.handle.net/11159/7991>

## Kontakt/Contact

ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics  
Düsternbrooker Weg 120  
24105 Kiel (Germany)  
E-Mail: [rights\[at\]zbw.eu](mailto:rights[at]zbw.eu)  
<https://www.zbw.eu/>

## Standard-Nutzungsbedingungen:

Dieses Dokument darf zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden. Sie dürfen dieses Dokument nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, aufführen, vertreiben oder anderweitig nutzen. Sofern für das Dokument eine Open-Content-Lizenz verwendet wurde, so gelten abweichend von diesen Nutzungsbedingungen die in der Lizenz gewährten Nutzungsrechte. Alle auf diesem Vorblatt angegebenen Informationen einschließlich der Rechteinformationen (z.B. Nennung einer Creative Commons Lizenz) wurden automatisch generiert und müssen durch Nutzer:innen vor einer Nachnutzung sorgfältig überprüft werden. Die Lizenzangaben stammen aus Publikationsmetadaten und können Fehler oder Ungenauigkeiten enthalten.

## Terms of use:

*This document may be saved and copied for your personal and scholarly purposes. You are not to copy it for public or commercial purposes, to exhibit the document in public, to perform, distribute or otherwise use the document in public. If the document is made available under a Creative Commons Licence you may exercise further usage rights as specified in the licence. All information provided on this publication cover sheet, including copyright details (e.g. indication of a Creative Commons licence), was automatically generated and must be carefully reviewed by users prior to reuse. The license information is derived from publication metadata and may contain errors or inaccuracies.*



<https://savearchive.zbw.eu/terms-of-use>



# The Increasing of Competitiveness of Agro-industry Products Through Institutional Empowerment to Support the Achievement of Sustainable Agricultural Development

Achmad Faqih<sup>1\*</sup>, Roosganda Elizabeth<sup>2</sup>, Delima Hasri Azahari<sup>2</sup>

<sup>1</sup>Agribusiness Study Program, Faculty of Agriculture, Gunung Jati Swada University Cirebon-Indonesia, <sup>2</sup>Socio Economic Center and Agricultural Policy, Tentara Pelajar Street No. 3B. Cimanggu, Bogor-Indonesia. \*Email: [afaqih024@gmail.com](mailto:afaqih024@gmail.com)

Received: 22 May 2020

Accepted: 04 August 2020

DOI: <https://doi.org/10.32479/ijeeep.10376>

## ABSTRACT

The aim of present literature is to examine the importance of institutional empowerment comprehensively related to the increasing competitiveness of agro-industry products in the perspective of bio-industrial agriculture for the achievement of sustainable agricultural development, which is enriched with a review of various studies and other related literature by using a quantitative descriptive method. The depletion of petroleum reserves and the length of the process of the formation of fossil fuel materials require us to immediately innovate to produce alternative and renewable energy, and some of them have been produced from various bio-industrial studies. The use of bioenergy in agro-industry is predicted to be able to make efficient and effective the use of fuel oil and GMP of its processed products. The findings also exposed that positive links among the renewable energy resources, management of natural resources, management of human resources and sustainability of agriculture development. These findings are provided with the guidelines to the policymakers that they should increase their emphases on the renewable energy that enhance the growth of the economy.

**Keywords:** Bio-refinery, Empowerment, Renewable Alternative Energy, Food Prosperity

**JEL Classifications:** Q16, L66, Q24

## 1. INTRODUCTION

Indonesia, as an agrarian country that has a very strategic position and role of agriculture to realize very competitive agriculture as the main vision of agricultural development, and become able to achieve self-reliance and food prosperity as well as energy. "The realization of a sustainable agriculture-bio industrial system that produces a variety of healthy food and high value-added products from biological resources and tropical marine," is the main vision of agricultural development based on sustainable bio-industry agriculture contained in the document SIPP (Main Strategy of Agricultural Development) 2015-2045 (Naz et al., 2019). In implementing this vision a bio refinery concept is implemented that optimizes the conversion of biomass that minimizes energy input and the concept of zero

waste to produce food and non-food materials that have high economic values (İşıtan et al., 2016).

The acceleration of the implementation of the system and concept of agriculture-bio-industry is closely related to the presence of at least five challenges in the agricultural sector at this time, there are: (1) an increase in the majority income of farmers' land <0.5 hectares; (2) agronomic challenges in increasing the production of agricultural commodities, especially food; (3) demographic challenges, to fulfil the food needs of a population that continues to grow; (4) challenges facing global climate anomalies in realizing sustainable agriculture; (5) challenges in facilitating the process of transforming the national economy from fossil-based to bio-economic. Related to those challenges, holistic and integrated handling of all stakeholders is needed to respond them, namely

the change and renewal of the paradigm of national economic development, from (i) agricultural paradigm for development (agriculture for development); towards (ii) the paradigm of a sustainable agriculture-bio-industry system. By a quantitative method, this paper comprehensively states the importance of institutional empowerment related to increasing competitiveness of agro-industrial products in the perspective of bio-industrial agriculture for the achievement of sustainable agricultural development, which is enriched with a review of various studies and other related literature. The weak point of the Indonesian economy is that the movement in the real sector has not been optimal yet, resulting in limited employment and business opportunities. The government is still struggling in preventing the poverty level and increasing unemployment because it is still a crucial problem today (Kurnianto et al., 2018). The toughness of the agricultural sector has proven to be less affected in the past crisis, and agricultural industrialization has strong links with other sectors, especially in the present, such as the relationship of consumption, investment, and labor (Handriyani, 2018).

## 2. LITERATURE REVIEW

The development of a sustainable agriculture bio-industry system is the implementation of the concept of bio-economics, which is the transformation carried out broadly, but gradually with different levels. Related to this, the development of the Integrated Agriculture-Energy System (SPET) becomes the first phase of emphasis (Eloheid et al., 2013). The development of SPET is also a strategy to improve the welfare of small farmers and poverty reduction in rural areas. In addition, to enable the development of sustainable agriculture systems, the concept of agriculture bio-industry also predicts the development of the concept of zero waste management, by integrating various socio-economic aspects of the agricultural community and environmental aspects. The process of forming fuel material derived from fossils takes a very long time and the depletion of petroleum reserves requires humans to immediately take various actions to produce fuel, substitute fuel and energy sources.

Various studies of bio-industry have been able to produce various types of renewable energy, especially when used in agro-industry efforts that are predicted to be able to make efficient and effective use of fuel oil and gas and GMP of its processed products (Yishai et al., 2016). By a quantitative method, this paper proposes more comprehensively the various businesses and opportunities as well as the development of bio-industry and agro-industry which are enriched with a review from various studies and writings and other related literature. The importance of managing natural resources and human resources from aspects of economic, social and environmental sustainability correctly and wisely. The importance of the development and expansion of various related infrastructure and equipment assistance program policies of the right type and target is intended to achieve the objectives of the program.

### 2.1. Sustainable Bio-industry Agriculture

Several trends' that have consequences and solutions, related to future agriculture, namely: (i) the importance of efforts to encourage economic transformation into bioenergy as anticipation

of increasingly the rare fossil fuels; (ii) the increasing urgency of bio-products, healthy lifestyles, and consumption patterns of bio culture as food, feed, energy and fiber needs increase; (iii) the importance of encouraging increased capacity of adaptation and mitigation to anticipate global climate change; (iv) the obligations and inevitability for efficiency and conservation activities as anticipation of the impact of land and water scarcity; (v) the development of ecological agriculture systems and bio services as an impulse from the demand to environmental services; (vi) the importance of applying pluricultural integrated bio-cycle systems as a result of increasing marginal farmers; (vii) the development of bio economics as an impact given from the progress of science and technology bio-science and bio-engineering.

The new paradigm of national economic development includes (1) the agricultural paradigm for development (agriculture for development), i.e., the national economic development plan that needs to be designed and implemented according to the stages of agricultural development and to place the agricultural sector as a driving force for a balanced and comprehensive agricultural transformation; (2) the paradigm of a sustainable agriculture bio-industry system with the transfer of fossil fuel-based industries to renewable (biological) fuels. This paradigm places the role of agriculture as a biomass producer of bio-refinery raw materials to produce food, feed, fibers, energy, and various other bio products, and the environment; which is a global issue of agricultural development that must be faced as a challenge to be able to develop environmentally-friendly agriculture by the application of technology through the development of bio-science, the innovation to face climate change (GCC innovation response), and bio-informatics that applies information technology (bio-information) with always prioritizing environmental sustainability and natural resources (Reches et al., 2019).

Indonesia has various types of raw materials that are capable of producing various types of bioenergy such as bio-gas, bio-diesel, bio-ethanol, bio-electricity and bio-actor produced from advanced processing; which continues to be improved by the acquisition and application of its use to minimize the use of fuel oil. Agricultural-based materials have great potential to become bio-industrial raw materials. Processing of various agricultural-based products and wastes that can produce them, among others from processing: oil palm, atrophy, pineapple, tapioca liquid waste, cattle manure (cattle, buffalo, horses, goats, and other cattle), from the results of the synthesis and distillation of another various agriculture-based product (Simoncini et al., 2019). To optimize its implementation, the main vision of agricultural development based on sustainable bio-industry agriculture is outlined in nine missions, there are: (i) spatial planning and agrarian reform (RA); (ii) integrated tropical farming systems; (iii) economic activities in production, information and technology; (iv) post-harvest, agro-energy and bio-industry rural-based; (v) marketing systems and product value chains; (vi) agricultural financing systems; (vii) quality research, innovation and human resources systems; (viii) agricultural and rural infrastructure; and (ix) imperative legislative, regulatory and management programs.

There are three principles of the sustainability of the bio-industrial agriculture system, which include: (1) self-financing:

self-financing as much as possible through mutually supporting and tiered businesses; (2) applying small-scale technology; and (3) businesses that are technically and economically feasible. Integration of dairy cows with oil palm that produces milk, palm oil, biogas (fermented cow dung), and pledge which is organic fertilizer, in Aceh Province can be used as an example of the application of the three principles (Choong et al., 2018). Related to these three principles, the integrated agriculture-energy system (SPET), which is the focus of the first stage of the Agriculture-Bio industrial Development, in the primary farming subsystem is based on biotechnological innovations that can produce as high biomass as possible as bioenergy-producing feedstock's; and to prevent trade-offs on food prosperity and energy endurance, the SPET in the bio-industry subsystem is based on bio-engineering innovations to process feedstock into energy and bio products, including fertilizer for farming.

## 2.2. Bio-industry Agriculture: The Application of Bioenergy Technology and Participation

From various writings and research results, it can be stated that various agricultural products can be processed into various types of bioenergy, which can be used for electricity fuel, transportation facilities, and heat sources for industry and so on. Bioenergy which is 60% of the new and renewable energy no longer needs high economic incentives. Bioenergy development can be carried out at all levels of the business scale, anywhere, and can involve all communities both rural and urban.

The availability of biomass is also very abundant in Indonesia which can be utilized to produce bio-electricity. Biomass has the potential to produce 49,810 MW of electricity, which if converted can generate incomes of around Rp. 501.8 T/year (electricity price is Rp. 1,150/kWh). Coal-fired power plants (around Rp.700-800/kWh) are also carried out in line with government policies to minimize fuel oil dependency so that electricity projects are accelerated. Coal usage is predicted to be around 75% cheaper than other power plants (BBM Rp. 3200/kWh), and saves around Rp. 71.4 T 2014 State Budget (APBN) finances fuel oil for PLTD electricity converted to the coal-fired power plant (Shahbaz et al., 2016). However, the use of coal fuel also produces 5% of solid pollutants (ash = fly ash and bottom ash), and this is where agriculture plays a role as the use of fly ash as an ameliorant that has high levels and saturation bases and contains complete nutrients so that it can increase peatland pH and can fix the structure of peat soil.

From the results of the synthesis of palm oil obtained various types of surfactants including DEA (ethanolamine), MES (metal ester sulfonate), APG (alkyl poly glycoside), AS (alcohol sulfate), sucrose ester, and others. Formerly, surfactants were formulated only to be limited to clean products (bath soaps, detergents), cosmetic products and other medicines. The idea to increase petroleum production by processing surfactants (most of which were imported) developed since 2003, and finally, it was able to be produced through collaborative research by ITB and PERTAMINA oil experts. Glycerol ( $C_3H_8O_3$ ) is a side product of the biodiesel industry that can be utilized in a variety of bio-industrial businesses, including: as an adaptive material in WBM (Water-Based Mud)

which increases the drilling mud to lubricate and cool the drill bit actively and efficiently. Glycerol through oleic acid esterification process with MESA catalyst is converted to glycerol ester which is potentially used for Oil Based Mud (oil-based drilling mud for oil well drilling needs) (Shahbaz et al., 2017).

Meanwhile, biodiesel from used cooking oil (used oil) can be used as a fuel oil mixture that aims to reduce carbon monoxide emissions and other fumes from vehicles. Meanwhile, bio-pellet is a type of biomass waste-based fuel (palm fronds, coconut cake, husk, corncobs, coffee husks, etc.) which is potentially used for bio-pellet production). Thus, various agricultural products and waste which produce from small to large scale production processes can be processed (bio-industrial) into a renewable energy source, organic fertilizer and other various product.

## 2.3. Agricultural-bio Industry Implementation: The Agro-industry Development

Food is a basic need that is essential and becomes human rights and as a source of energy, power and strength for every creature to live and do activities every day. Indonesia has a wealth of natural resources almost in the whole territory which produces various kinds of foodstuffs and another economic valuable commodity. Besides rice (as a staple food), sago, sorghum, cassava, corn, are plants that produce carbohydrates as a fulfilment food and energy, as well as bioenergy. Energy is very vital for life and its fulfilment greatly influences the ongoing various economic activities. Various alternative energy and renewable energy can be produced from various food commodities, horticulture, and other industrial plants. Corn-based bio-industry products as part of an integrated energy agriculture system technology, in addition to being a food source and various processed products, corn can also be used to feed raw materials. Corn waste can also be optimized as an energy source that provides real added value through the processing process. Multiproduct from corn, including: (i) food (corn, shelled corn, cornstarch (maize), corn starch, instant corn rice, grits); (ii) fiber (fiber/ampok); (iii) feed (animal feed from clobots, stems, cob, and corn leaves); and (iv) fuel (bio-ethanol).

Sago plants are native plants of Indonesia that are present and have great potential in the Papua territory (90%) and in several other territories such as Aceh, Tapanuli, West Sumatra, Riau, Kalimantan, West Java, North and South Sulawesi, where the distribution zones do not reflect its limit of potential productions. Sago bio-industry management starts from the good seed criteria, thinning tillers will determine whether good or not the growth of sago, until the proper processing of sago harvests becomes very crucial and important to obtain and maintain the quality and quantity of sago starch (Shahbaz et al., 2015). The development of sago cultivation and bio-industry faces various problems that must be handled wisely, such as (i) the natural resources of sago has not been managed well, one of them is because it is still limited to family consumption and there are still many sago plants ready for harvest left to dry and die; (ii) sago factory production machinery that is not optimal yet due to inadequate electrical energy support, the human resources for postharvest and processing which are relatively low, and incompatible postharvest and processing equipment; (iii) the tree cutting is still manual; (iv) the absence



of regulations and institutions that accommodate sago farmers, in terms of production, processing and marketing of sago.

Bio-industry through the use and optimization of sorghum for domestic use as food, fibre, energy (source of bio-ethanol/ alternative energy), liquid organic fertilizer, functional food, and animal feed (1 hectare of sorghum is enough to feed 6 fattening cows Like the sorghum plant in NTT which produces 30-45 tons of sorghum stems and from it obtained 15-20 tons of sorghum sap if when processed (bio-industry) through fermentation uses enzymes at the optimum temperature (= distillation process with a heating temperature of 78-100°C in the distiller) and purification can produce 1.2-1.6 tons of bioethanol with a purity level of 61-95%, and CO<sub>2</sub>. Almost all parts of sorghum plants can be utilized. As a food, sorghum has better nutrition than rice and cassava (Table 1), and it ranks after wheat, rice, corn and barley. Various foods from sorghum processing, such as (i) types of bread without yeast (*chapatti, tortillas*); (ii) types of bread with yeast (*injera, kisia, dosai*); (iii) thick porridge (*to, tuwu, ugali, bagobe, sankati*); (v) liquid porridge (*ogi, ugi, take, edi*); (v) snack foods (*sorghum pop, sorghum tape, sorghum chips*); (vi) boiled sorghum (*urap sorghum, som*); (vii) steamed food (*couscous, wowoto, juadah-sorghum*); etc.

As an industrial material (bio-industry), sorghum seeds contain 65-71% starch which can be hydrolyzed into simple sugars (sugar or liquid glucose or fructose syrup) which then can be fermented to produce alcohol (1 ton of sorghum seeds can produce 384 liters of alcohol). Sorghum seeds can be made of starch (white starch), which is used by industry for adhesives, thickening materials, additives in the textile industry, and the side-products are used as feed. Starch is the main ingredient in various food processing systems, such as main energy source, acts as a determinant of the structure, texture, consistency, and appearance of food; and can be a substitute for the corn starch industry, but there are few obstacles in its extraction due to binding of sorghum starch, it is around 35-38% while it is around 8-15% in corn. Another important bio-industry product of sorghum seeds is beer, where the seeds can replace barley in brewing. Bioethanol as alternative energy is used for fuel (95% content, must be pure, fuel grade ethanol) with lower exhaust rate of gas/carbon monoxide (Shahbaz et al., 2016). Pineapple and cassava bio-industry produce canned pineapple and tapioca flour (*aci*) and produce bio-gas energy from tapioca liquid waste processing and pineapple processing which can replace fuel oil energy sources. Moreover, solid waste from pineapple and tapioca factories is used for cattle feed; cow dung is processed

into compost (organic fertilizer) for pineapple garden, cassava and other plants; and the company (PT GGP/Great Giant Pineapple set a target along with 30-40-50, which means reducing: 30% fuel oil, 40% chemicals and 50% an increase of product result.

As animal feed, the nutritional value of seeds, leaves and stems of sorghum is no less than corn and it is more supplementary. Stems (containing quite high sugar content, preferably by a cow) and sorghum leaves must be withered about 2-3 h before being given to cattle. Sorghum seeds are also used for poultry feed (chicken and quail) as a substitute for corn flour because it has a fairly good protein value (11%). Bio-slurry (bias pulp) is used for agriculture, cattle and fish. Its use as a separate organic fertilizer and/or combined with synthetic fertilizers wisely and regularly, both in the form of solids and liquids. It can increase land fertility and reduce pests and diseases so that the impact is increasing agricultural production. There are three forms of bio-slurry: fresh, solid and liquid. Various uses of bio-slurry, such as (1) fresh bio-slurry, for vermeil-compost, land-based fertilizer and ponds; (2) solid bio-slurry, for land-based fertilizer and ponds, organic fertilizer mix, soil cleaning, mushroom media mix, non-cow alternative feed mix; (3) bio-slurry, for liquid organic fertilizers, biological fertilizers, organic pesticides, decomposers, plant hormones, seed protectors, cage odor (Shahbaz et al., 2018).

Agro-industry which is a processing industry activity/business is needed to overcome the nature of agricultural products which are generally perishable and seasonal, especially horticultural products, become into various processed products. To overcome the results of farming that have not been able / not sold out yet, agro-industry is needed to process it (heating, fermentation, drying, cooling, packaging, canning, etc.) so as not to lose due to damage/rot, which of course requires additional costs. Harvests should be sold immediately after harvesting (mainly horticultural commodities). Agro-industry is also defined as a business, process and policy program to build the competitiveness of agricultural products, empower capabilities and improve the performance of human resources to do it, be fair and sustainable to ensure food prosperity, and the welfare of the agricultural community (especially farmers), taking into account the preservation of natural resources and the environment, to remind that the majority of the poor population lives and makes a living in this sector, especially agriculture in a broad meaning (Shahbaz et al., 2013).

Farmer limitations related to the relatively weak the bargaining position, it can be studied in the subsystem between (middle) to downstream consisting of collectors and wholesalers who are the main supplier for processed product business players. This is more due to the large number, uniformity (shape and quality) in accordance with the specifications desired by the business industry of processed products and the continuity of raw material supply. In this subsystem, collectors and wholesalers are function and act as suppliers of industrial raw materials (growers). Collector and wholesalers also distribute it to various regions that need it. Furthermore, sorting and trading activities are carried out by wholesalers that receiving supplies in their area (related to distribution and sales).

**Table 1: Nutrition values of sorghum, rice, corn, cassava, soybeans**

Nutrition	Content per 100 g				
	Rice	Sorghum	Cassava	Corn	Soybeans
Calories (Cal)	360	332	146	361	286
Protein (g)	6,8	11	12	8,7	30,2
Fat (g)	0,7	3,3	0,3	4,5	15,6
Carbohydrates (g)	78,9	73	34,7	72,4	30,1
Calcium (mg)	6	28	33	9	196
Iron (mg)	0,8	4,4	0,7	4,6	6,9
Posfor (mg)	140	287	40	380	506
Vit. B1 (mg)	0,12	0,38	0,06	0,27	0,93

## 2.4. Role of Empowerment to Agriculture Institutions in the Development of Agricultural Bio-industry and Agro-industry

The role of institutions in building and developing the agricultural sector in Indonesia is particularly can be seen in agricultural activities. At the national macro level, the role of agricultural development institutions is very prominent in the programs and projects of intensification and increase in food products. Agricultural development activities are outlined in the form of programs and projects by building agricultural institutions. Agricultural institutions are norms or habits that are structured and patterned and also practiced continuously to fulfil the needs of community members who are closely related to the livelihoods of rural agriculture. In the life of the farmers' community, the position and function of farmer institutions are as part of social institutions that facilitate social interaction or social interplay within a community (Chaudhary et al., 2019). The farmer institutions also have a strategic point (entry point) in driving the agribusiness system in rural areas (Sánchez-Mejía, 2018). For this reason, all resources in rural areas need to be directed/prioritized to increase professionalism and bargaining position of farmers (farmer groups). At present, the portrait of farmers and farmer institutions in Indonesia is recognized but as not yet as expected (Paroda, 2019).

The above conditions indicate the significance of institutional empowerment in accelerating the development of the agricultural sector (agro-industrial processed products). This is in line with the results of various observations which conclude that if the agricultural development initiative is carried out by an institution or organization, where individuals who have an organizational spirit combine their knowledge in the planning and implementation initiative stages, then the chances of success in agricultural development will be even greater.

To protect the agricultural sector from competition in world markets in order to support the success of agro-industrial processed products, several policies are needed, including: (i) fight for the concept of strategic product (SP) in the WTO forum; (ii) applying tariffs and non-tariff barriers to agricultural commodities that is considered very sensitive; (e) Industrial development policies that more emphasize to small-scale agro-industry in rural areas in order to increase the added value and income of farmers; (f) Investment policies that is conducive to further encouraging investor interest in the agricultural sector; (g) Development financing that prioritizes the budget for the agricultural sector and its supporting sectors; (h) The local governments' attentions in agricultural development includes: agricultural infrastructure, empowerment of agricultural extension workers, development of agricultural scope agencies, eliminating various levies that reduce agricultural competitiveness, and also adequate budget allocation.

Trade globalization includes a variety of challenges that should be interpreted as opportunities for Indonesian processed products to be able to compete in international markets, including (i) the solid domestic market of the product, so that it is not only flooded with imported products; (ii) the supply of safe, hygienic, high-quality and guaranteed products and competitive prices; (iii) continuous

supply of products and adequate support of environmental conditions and facilities. To improve the competitiveness of Indonesian trade products, the diversity of domestic agricultural product processing technologies in each region must be able to be utilized and adapted to global conditions as a source of strength in the development of competitive agro-industrial products (Peters and Pingali, 2018).

As an effort to develop and increase competitively-processed agro-industry products, it is needed to increase production efficiency and quality through improved production, post-harvest and processing systems (GAP and GMP). The competitiveness of Indonesian agricultural commodity processed products is still relatively weak because it only relies on the comparative advantage of the abundance of natural resources and uneducated labor (cost driven factor) so that the products produced are dominated by natural primary products (resource-based and unskilled-labour intensive). The flood of processed products abroad should be interpreted as challenges and opportunities that must be faced by increasing the competitiveness of processed products by accelerating and developing a domestic agro-industry performance that improves product quality, quantity and efficiency. With efforts to reduce imports of processed products, exports gradually change from primary agricultural products (raw materials) to processed products (Mutenje et al., 2016).

The development of agro-industry to increase the competitiveness of processed products and the development of export markets (global), and multi-utility (double profits) are: (a) as an export promotion as well as import substitution, (b) to create agricultural added value, (c) to create industrial employment, and (d) to increase technology adoption. The increase of the value-added of agricultural products is one of the main targets of the ministry of agriculture in the context of developing agro-industry, through the increase of processed products traded, the development and improvement of processed products based on agricultural products and aimed at exports to obtain the increase of the foreign trade surplus.

All types of agricultural, plantation and animal husbandry commodities in Indonesia have a strategic function and role as components and raw materials for food needs (medicines), clothing (cosmetics), as well as including tools, and furniture. Almost all of these final products have entered the export market and they are developing quite well. In the perspective of law/regulation and policy, the government has a political-economic manner to build the prosperity of the nation, especially in the future. Agro-industrial businesses can be used as a source of income for the majority of the population (along with the development of the primary agricultural sector, as employment and a place of business, which is expected to increase income acquisition and realize the welfare of farmers. The implementation of agro-industry acceleration and the achievement of the added value of processed products can support the achievement of product competitiveness and acceleration of agricultural development in Indonesia. Therefore, revitalization of agro-industry activities is needed as a breakthrough action and strategy and also to make it as a locomotive of national economic growth.

Agro-industry also has strong links between sectors that are not only product-related but also through consumption, investment and labor linkages. The linkage is due to manpower and capital being reallocated to the processing (from primary products to processed products) which is equipped with a business feasibility analysis; which includes: general viability, financial viability, economic viability, social and environmental viability, technical viability, infrastructure support; and policy, as supporting data. Various studies and research can be done to determine the benefits and feasibility of the performance of agro-industry is a type of agricultural commodity both crops, horticulture, plantations, livestock, and so on. Based on Permeating (Regulation of the Minister of Agriculture) No. 35/Permeating/OT.140/7/2008 concerning Processing of agricultural products from plants is to change raw materials into primary products, semi-finished or finished products, which aims: To increase the shelf life or increase the added value of agricultural products; and minimize the losses because the added value of the product is taken over by other countries (Reghunath and Kumar, 2018).

Regarding Law No. 13 of 2014 concerning Industry, several considerations regarding the need and importance of the implementation of business activities based on agricultural products and their development include: (i) Indonesia's natural resources are rich and spread evenly throughout the country, so it is necessary to encourage the business of the processed product industry; (ii) creating job opportunities as wide as possible; (iii) increasing value-added; (iv) to increase income related to the welfare of the farmer; (v) to open up export opportunities; and (vi) it is believed to have an impact and create equitable development. The strategy is a result of the intelligent attitude that management of natural resources must be improved and developed so that the implementation and acceleration of revitalization of agro-industry activities are needed. The issuance of Law No. 13 of 2014 concerning Industry, should be interpreted as an affirmation that the national industrial system has substantively provided the correct direction for regulation on the importance of developing natural resource-based industrial sectors (Reghunath and Kumar, 2018).

Indonesia's agricultural development should immediately anticipate the development of processed products through accelerated implementation of agro-industry (agricultural industrialization) so that exports of agricultural products can gradually change from primary products (raw materials) to processed products. Various problems arise related to the inability of domestic agro-industries related to their development efforts to produce quality and competitive processed products, diversity and level of market demand, accompanied by complete regulations and siding rules of farmers producing raw materials. There are at least 5 components in the agro-industry product business (agribusiness), namely: (i) supplier and distributor of production input, *alsintan*; (ii) agricultural products (primary/unprocessed products); (iii) agro-industry; (iv) marketing of various agricultural products; (V) public services (storage, banking, transportation, insurance). The marketing of agricultural products is generally a critical point in the business chain of various agribusiness products, especially agro-industrial products in: because of the limited time and location

of implementation and depends on the role of collector trader. About marketing, its role as a forum for transaction activities (selling/buying) needs to be empowered to facilitate stakeholders to access and ease of obtaining the items needed.

### 3. RESEARCH METHODS

The aim of the existing study is to inspect the importance of institutional empowerment comprehensively related to the increasing competitiveness of agro-industry products in the perspective of bio-industrial agriculture for the achievement of sustainable agricultural development, which is enriched with a review of various studies and other related literature by using a quantitative descriptive method. The data was retrieved from World Development Indicate (WDI) and STATA was employed to test the hypotheses. Institutional empowerment of agro-industry product is measured by three elements such as renewable energy resources (RER) with the management of natural resources (MNR) and management human resources (MHR). The competitiveness is measured by the sustainability of agriculture development (SAD) and based on the above mentioned literature the present study develops the following equation.

$$SAD_{it} = \alpha_0 + \beta_1 RER_{it} + \beta_2 MNR_{it} + \beta_3 MHR_{it} + e_{it} \quad (1)$$

Where

SAD = Sustainability of agriculture development

RER = Renewable energy resources

MNR = Management of natural resources

MHR = Management of human resources.

### 4. FINDINGS

The first assumption is multicollinearity that means the constructs are not highly correlated that is calculated by the following equations:

$$R^2_{RER} \quad RER_{it} = \alpha_0 + \beta_2 MNR_{it} + \beta_3 MHR_{it} + e_{it} \quad (2)$$

$$R^2_{MNR} \quad MNR_{it} = \alpha_0 + \beta_2 RER_{it} + \beta_3 MHR_{it} + e_{it} \quad (3)$$

$$R^2_{MHR} \quad MHR_{it} = \alpha_0 + \beta_2 MNR_{it} + \beta_3 RER_{it} + e_{it} \quad (4)$$

$$j = R^2_{RER}, R^2_{MNR}, R^2_{MHR}, \quad (5)$$

$$Tolerance = 1 - R^2_j \quad (6)$$

$$VIF = \frac{1}{Tolerance} \quad (7)$$

The figures show that no issue with multicollinearity assumption and variance inflation factor (VIF) is given below in Table 2.

The second assumption regarding the normality is verified by using the Skewness and kurtosis test is calculated with the help of the following equation:

$$Skewness = \sum Ni = 1(Y_i - \bar{Y})^3 / Ns^3$$



**Table 2: Variance inflation factor**

Variables	VIF	1/VIF
RER	2.616	0.382
MNR	2.414	0.414
MHR	2.039	0.491
Mean VIF	2.239	.

$$\text{Kurtosis} = \sum Ni = 1(Yi - Y^-)4 / Ns4 \quad (8)$$

The figures show that data has abnormality issues and Skewness and Kurtosis test is given below in Table 3.

The third and four assumptions regarding the autocorrelation and heteroscedasticity also confirmed by using the Wooldridge test and Breusch-Pagan test results show that data has both the issues and fixed the effects of both the issues by using the GMM estimator.

The findings also exposed that positive links among the RER, MNR, MHR and SAD because all the beta have a positive sign and t-values and P-values meet the standard and Table 4 given below show the path analysis of the study.

## 5. DISCUSSIONS

The findings also exposed that positive links among the renewable energy resources, management of natural resources, management of human resources and sustainability of agriculture development. These findings are similar to the outcomes of Liu et al. (2017) who also examined that renewable energy is an essential part of agriculture development in the country. A study by Alola and Alola (2018) exposed that positive association has been found among the consumption of renewable energy and agriculture development and these outcomes are the same as the output of the present study. These findings are provided with the guidelines to the policymakers that they should increase their emphases on the renewable energy that enhance the growth of the economy. The policy of construction and agro-industry development in rural areas, especially to encourage the creation of a balanced economic structure. The development of agro-industry is intended to play a role in the creation of added value (value-added), absorption and productivity of labor and markets; it needs to be accompanied by programs that go directly to the target (farm households as subjects), where agro-industrial development is combined with rural development so that it becomes a comprehensive rural development program, namely: "Rural-agro-industrial development." To improve these conditions, it requires development and empowerment that starts from the community to be essential to achieve optimum synergy in its activities at the local level; to help the increasing towards industrialization; and to make it easier for farmers to develop agro-industrial systems (Reghunath and Kumar, 2018).

In planning and implementing agricultural development at rural areas, it should be emphasized the improvement of a variety of agro-industries that are efficient and effective and also to increase income, employment and business opportunities in rural areas. As an advocate for agricultural development, agro-industry is

**Table 3: Skewness and Kurtosis test**

Variable	Obs.	Pr. (Skewness)	Pr. (Kurtosis)
SAD	152	0.000	0.002
RER	152	0.001	0.000
MNR	152	0.000	0.003
MHR	152	0.000	0.000

**Table 4: Path analysis (GMM estimator)**

SAD	Beta	S.D.	t-values	P-values
RER	0.611	0.123	4.950	0.000
MNR	0.089	0.017	5.260	0.000
MHR	0.016	0.008	2.050	0.049
_cons	4.420	1.165	3.790	0.001

expected to be able to create a variety of agricultural products and processed products, to be able to drive rural industrialization and also be able to create employment and income at rural areas. Some obstacles in the development of agro-industry, include: (i) the processing technology that is not yet developing because it is still small and limited to capital resources; (ii) low-quality human resources which are not professional yet; (iii) inadequate facilities and infrastructure; (iv) the low quality of assurance and continuity (availability) of raw materials; (v) the marketing that has not yet developed because the agricultural processing industry products have not met market requirements, especially international markets; (vi) there are no real policies that encourage the development of domestic agro-industry.

Strengthening product processing technology with the empowerment and participation of farmer communities is one of the important and supporting factors in the development of agro-industry at rural areas so that technology development and investment programs can become a "driving engine" for resilient economic progress at rural areas. To grow the rural economy it is necessary to strengthen community social networks that are efficient (both from the structure/configuration aspects), membership (level of community participation), or role or function (an organic division of work). Various socio-economic aspects of rural agriculture and the marketing of processed products need to be addressed in the process and support the development of agro-industry, it must be able to play a role in increasing the value-added of processed products, absorption and productivity of the workforce, and expanding the reach of marketing through quantitative studies. The implementation of sustainable agriculture bio-industry should be able to fulfil some profit criteria, which include benefits: economic, social, conservation and sustainability of natural resources (SDA), land ecosystems and healthy and natural environmental quality wisely and sustainably. Sustainable agricultural systems are also the backbone (backbone) for the realization of independence and food prosperity. Related to the shrinking of petroleum which is still become one of the main energy sources, various agricultural-based materials and materials can be further processed to produce bioenergy substituting fuel oil (BBM) and or intended to increase petroleum production (for example surfactants from the products palm oil synthesis) (Radhakrishnan and Francis, 2017).

Various regulations/policies on industrialization, related to agro-industry, especially food crops, were taken to strengthen the



bargaining position and increase the competitiveness of various processed products in regional and international markets. Its implementation also confirms that industrialization is a strategic step to process agricultural products (agro-industry) as a result of strategic natural resources and must be pursued by strengthening the final and initial process in the agro-industry sector, as well as strengthening the bargaining position of various processed products based on Indonesian food crop agriculture, both in regional markets and in the world market (international). Its implementation is predicted as a result of the improvement and development of natural resource management. It also makes the Indonesian people gradually be able to break away from the trap of paradox of plenty (a condition where a country is rich in natural resources but the people are poor). Thus, Indonesia's extraordinary agricultural potential can be utilized to the widest possible extent to realize independence, sovereignty, national food and energy prosperity through an appropriate and consistent implementation policy by the government, sustainable and always prioritizing environmental sustainability and natural resources (Radhakrishnan and Francis, 2017).

## 6. CONCLUSIONS AND IMPLICATIONS OF POLICY

- The agricultural sector remains a potential source of income and employment opportunities
- Efforts to improve the productivity and welfare of farmers as farming business actors must continue to utilize the bioenergy and diversity innovation and develop agro-industry of processed products as well as agro-industry products for crops and work opportunities outside the agricultural sector. Work system improvements (catch, profit-sharing, etc.) and wages, mobility, mobility and labor information
- Infrastructure development, education and development of labor skills (especially women), the participation of all business actors, improvement and enhancement of quality and the ability (competency) of agricultural human resources seriously, intensively and sustainably to be able to utilize bioenergy sustainably
- The importance of supporting the improvement and development of bioenergy technology to increase production and productivity as well as work and business opportunities (agro-industry of processed products)
- The importance of alignments and government support for the role of farmer groups of processed products, especially with the policy program of training and technology guidance intensively and continuously in the use of bioenergy to produce processed products, and to realize the strengthening of farmer groups of processed products from the upstream subsystem (aquaculture) to the downstream subsystem (marketing and being a business actor of processed products) in accordance with the concept of value chain market-based solutions
- The importance of empowering land resources (land, water, minerals and air), biological resources (humans, animals, plants, and other living things) environmental resources (interactions between creatures), 6 M (man, money, materials, machines, methods, management), as well as the participation of all business actors and related parties
- Synergy needs to be done optimally and integrated with regard to the implementation of sustainable bio-industry agriculture programs so that all stakeholders have the will, ability, opportunity and authority to make real contributions and obtain optimal benefits
- The importance of uniformity and mutual agreement/commitment of each of the stakeholders in the central level to the regional level, so that it can help the coordination and implementation of work programs in the region smoothly
- The importance of natural resource management in terms of economic, social and environmental sustainability correctly and wisely
- The importance of various regulations and institutions that accommodate a variety of bio-industrial and agro-industrial activities starting from the side of production, processing, marketing and sustainability
- The importance of developing bio-industry and agro-industry businesses, especially in rural areas, that indicates an increase in the quality and competence of human resources and of course has an impact on increasing income acquisition which is supposed to be able to realize food self-sufficiency and security and farmers' welfare.

## REFERENCES

- Alola, A.A., Alola, U.V. (2018), Agricultural land usage and tourism impact on renewable energy consumption among Coastline Mediterranean countries. *Energy and Environment*, 29(8), 1438-1454.
- Chaudhary, R., Janjhua, Y., Kumar, K. (2019), Women empowerment and agricultural development: Research insights. *Agric International*, 6(1), 62-67.
- Choong, Y.Y., Chou, K.W., Norli, I. (2018), Strategies for improving biogas production of palm oil mill effluent (POME) anaerobic digestion: A critical review. *Renewable and Sustainable Energy Reviews*, 82, 2993-3006.
- Elobeid, A., Tokgoz, S., Dodder, R., Johnson, T., Kaplan, O., Kurkalova, L., Secchi, S. (2013), Integration of agricultural and energy system models for biofuel assessment. *Environmental Modelling and Software*, 48, 1-16.
- Handriyani, R. (2018), Analysis Effect of Household Consumption, Investment and Labor to Economy Growth in Sumatera Utara. Paper Presented at the Proceeding AISTEEL the First Annual International Seminar on Transformative Education and Educational Leadership.
- Işitan, S., Ceylan, S., Topcu, Y., Hintz, C., Tefft, J., Chellappa, T., Goldfarb, J.L. (2016), Product quality optimization in an integrated biorefinery: Conversion of pistachio nutshell biomass to biofuels and activated biochars via pyrolysis. *Energy Conversion and Management*, 127, 576-588.
- Kurnianto, F.A., Rakhmasari, D., Ikhsan, F.A., Apriyanto, B., Nurdin, E.A. (2018), The environment analysis of population growth, unemployment, and poverty level in maesan district bondowoso regency. *Geosfera Indonesia*, 3(2), 113-121.
- Liu, X., Zhang, S., Bae, J. (2017), The impact of renewable energy and agriculture on carbon dioxide emissions: Investigating the environmental Kuznets Curve in four selected ASEAN countries. *Journal of Cleaner Production*, 164, 1239-1247.
- Mutenje, M., Kankwamba, H., Mangisonib, J., Kassie, M. (2016), Agricultural innovations and food security in Malawi: Gender

- dynamics, institutions and market implications. *Technological Forecasting and Social Change*, 103, 240-248.
- Naz, S., Sultan, R., Zaman, K., Aldakhil, A.M., Nassani, A.A., Abro, M.M.Q. (2019), Moderating and mediating role of renewable energy consumption, FDI inflows, and economic growth on carbon dioxide emissions: Evidence from robust least square estimator. *Environmental Science and Pollution Research*, 26(3), 2806-2819.
- Paroda, R. (2019), Women empowerment for agricultural development. *LS: International Journal of Life Sciences*, 8(3), 157-164.
- Peters, G., Pingali, P. (2018), *Tomorrow's Agriculture: Incentives, Institutions, Infrastructure and Innovations-Proceedings of the Twenty-fourth International Conference of Agricultural Economists: Incentives, Institutions, Infrastructure and Innovations-Proceedings of the Twenty-Fouth International Conference of Agricultural Economists*. London: Routledge.
- Radhakrishnan, S., Francis, A. (2017), Information repackaging services in research and development organisations: A study with special reference to agricultural research institutions in India. *Journal of Knowledge and Communication Management*, 7(1), 40-48.
- Reches, A., Weiss, K., Bazak, L., Feldman, H.B., Maya, I. (2019), From phenotyping to genotyping-bioinformatics for the busy clinician. *European Journal of Medical Genetics*, 62(8), 103-106.
- Reghunath, N., Kumar, N.K. (2018), Extent of awareness of farmers on ITD methods implemented by different agricultural institutions in Kerala. *Asian Journal of Agricultural Extension Economics and Sociology*, 10(2), 1-7.
- Sánchez-Mejía, M. (2018), *Innovation in Small Farmers' Economies (IECAM): Good Agricultural Practices of Healthy Agriculture with Associated Rural Enterprises in the Northern Cauca Area in Colombia Globalization and Health Inequities in Latin America*. Berlin: Springer. p205-218.
- Shahbaz, M., Jam, F.A., Bibi, S., Loganathan, N. (2016), Multivariate granger causality between CO<sub>2</sub> emissions, energy intensity and economic growth in Portugal: Evidence from cointegration and causality analysis. *Technological and Economic Development of Economy*, 22(1), 47-74.
- Shahbaz, M., Khan, S., Ali, A., Bhattacharya, M. (2017), The impact of globalization on CO<sub>2</sub> emissions in China. *The Singapore Economic Review*, 62(4), 929-957.
- Shahbaz, M., Loganathan, N., Zeshan, M., Zaman, K. (2015), Does renewable energy consumption add in economic growth? An application of auto-regressive distributed lag model in Pakistan. *Renewable and Sustainable Energy Reviews*, 44, 576-585.
- Shahbaz, M., Mahalik, M.K., Shah, S.H., Sato, J.R. (2016), Time-varying analysis of CO<sub>2</sub> emissions, energy consumption, and economic growth nexus: Statistical experience in next 11 Countries. *Energy Policy*, 98, 33-48.
- Shahbaz, M., Nasir, M.A., Roubaud, D. (2018), Environmental degradation in France: The effects of FDI, financial development, and energy innovations. *Energy Economics*, 74, 843-857.
- Shahbaz, M., Solarin, S.A., Mahmood, H., Aroui, M. (2013), Does financial development reduce CO<sub>2</sub> emissions in Malaysian economy? A time series analysis. *Economic Modelling*, 35, 145-152.
- Simoncini, R., Ring, I., Sandström, C., Albert, C., Kasymov, U., Arlettaz, R. (2019), Constraints and opportunities for mainstreaming biodiversity and ecosystem services in the EU's common agricultural policy: Insights from the IPBES assessment for Europe and Central Asia. *Land Use Policy*, 88, 104-109.
- Yishai, O., Lindner, S.N., de la Cruz, J.G., Tenenboim, H., Bar-Even, A. (2016), The formate bio-economy. *Current Opinion in Chemical Biology*, 35, 1-9.