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Value added of kenaf fibre in natural fibre agroindustry supply chain network

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Abstract. I Indonesia is among countries that produce fibre, which potentially becomes a flagship product domestically and internationally. Domestic demand for dried kenaf fibre reaches 30,000 tonnes/year, resulting in a gap between production and consumption. This study aims to analyse supply chain condition of kenaf fibre agroindustry, as well as analysing value added gained from an upstream supply chain of kenaf fibre agroindustry. Descriptive analytics method was employed to analyse supply chain condition. Whereas, value added was analysed using a number of methods: input output analysis, Hayami, modified Hayami, Rucker plan, and Tololiu's value added. This study has demonstrated value added of kenaf fibre in supply chain network. Input output analysis by Central Bureau of Statistics (CBS) is the most appropriate method to determining the value added of kenaf fibre. It is IDR159,982,877 and IDR1,066,718,000 for woven fabric.

1. Introduction

Indonesia is among countries that produce fibre, which potentially becomes a flagship product domestically and internationally. The type of fibre discussed is derived from kenaf (*Hibiscus cannabinus* L.) plant, cultivated in only 3,000 Ha of productive land [1]. However, domestic demand for dried fibre reaches 30,000 tonnes/year [2]. Dried fibre derived from bast of kenaf is the most widely produced, and is used in a number of industries in Indonesia. Kenaf fibre as raw material for the automotive and textile industries are two types of industries that are declared to be priority industry by the President of the Republic Indonesia in Making Indonesia 4.0 [3]. This research aims to analyse supply chain condition of kenaf fibre agroindustry and analyses potential value added calculated with different methods. Analysis of supply chain condition was performed with a descriptive analytics approach developed by Lambert and Cooper in 2000 in [4]. Analysis on value-added was carried out using 7 methods, i.e. analysis of input-output [5]–[7], Hayami [8], modified Hayami [9], Rucker plan [10], and Tololiu's value added analysis [11].

2. Literature review

2.1. Definition of value added

Value added is described as a measure of loss that will result in national revenue and growth of international economy [12]. Furthermore, [13] argued that value-added is a measure of performance in dealing with economic profit of a company. Value added is defined as a final value of product deducted by all materials, inputs, and services purchased from other companies.

In a research of agrifood, value added was used to characterize food products converted from raw state through processing that provides a value added to products manufactured [14]. Some studies have defined value added as value addition or enhancement from raw products into other products as they have passed through certain steps of processing [11][15][16][17][18][19][20]. The presence of industries converting primary forms into new products whose economic value is higher after processing steps, is able to provide value added and increase profit compared to those without processing steps [21].

The research conducted in a coffee agroindustry company [22] reported that value added is a trigger and booster of an industry's growth and development. Enhancement in value added can be achieved by incorporating environment aspect in a broiler industry [23]. Employment of advanced technology that transforms conventional process into automatic process in passion fruit syrup agroindustry activities is potential to enhance value added of the products [24].

A number of researches argued that value added can be gained by analyzing inputs and outputs. Value added is a difference between output value and cost of materials and input processing [9]. Another research [6] claimed that value added is calculated from market price (gross value added) and production cost (net value-added) which is obtained from gross value-added deducted by indirect taxes. In addition, [25] reported that value added is an economic parameter that describes a difference between number of production (output) and an average cost (cost spent during the production process) of products, either goods or services.

This study defines the meaning of value added as an enhancement in value of a product that occurs through transformation process (biological, chemical, physical, mechanical), which is economically measurable and is very dependent on market. Value added is a result of collaboration among stakeholders through information sharing to achieve consumer satisfaction, since enhancement in value-added is an economic scale that will voluntarily be spent by consumers. Added value is greatly influenced by costs caused by changes in raw materials to finished products and labor contributions.

2.2. Methods of value-added analysis

This study reviews some methods of value added analysis on kenaf fibre that have been employed by previous researchers. Researches on [16] a pineapple agroindustry, [17] beef floss agroindustry, [18] supply chain of calina papaya agroindustry, [22] sea cucumber ginger coffee agroindustry, [19] palm sugar agroindustry, [20] agroindustry of purple sweet potato products, [21] processing agroindustry of various foods, [25] agroindustry of craft bag made of water hyacinth, and [24] agroindustry of passion fruit syrup employed Hayami method to analyse their value-added, while another research on agroindustry of crude palm oil employed a modified Hayami method [9].

3. Method

3.1. Research framework

Three works carried out in this study include descriptive analytics on supply chain of kenaf fibre agroindustry. These three works are expected to improve income of farm labours, fibre harvesting farmers, and processing farmers in upstream supply chain of kenaf fibre agroindustry. As well as to enhance the value added in intermediate and downstream industry. The textile industry and its derivative products have been selected as supply chain networks in the intermediate and downstream industries. It is presented in Figure 1.

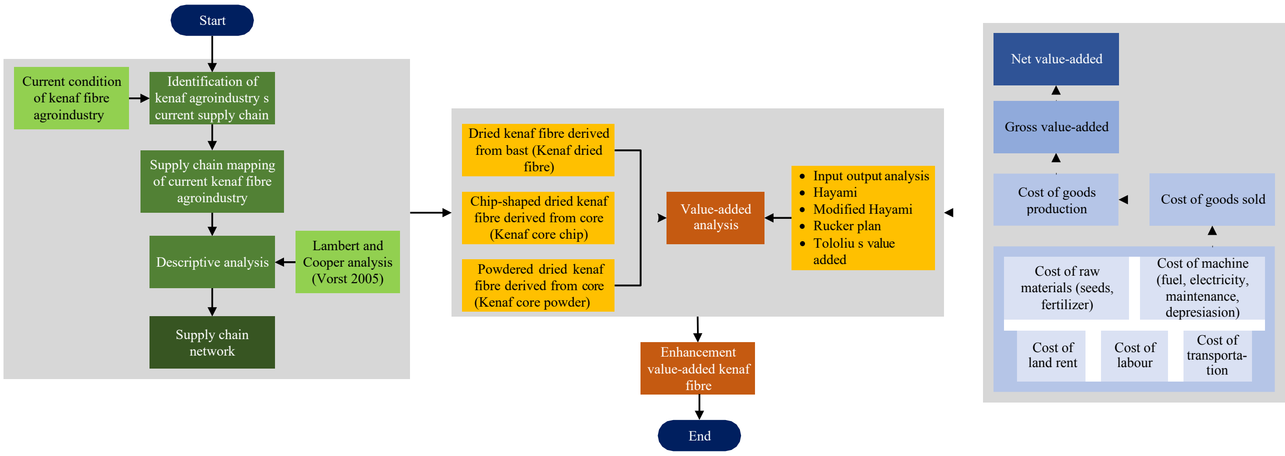

Figure 1. Research framework.

3.2. *Input output analysis*

There are four input output analysis methods that have been reviewed in this study. Those are input output analysis by CBS [5], Gultom [6], and Aoudji [7]. The mathematic formulation used to obtain value-added by these methods are as provided in formulation 1-9.

3.2.1. *Input output analysis by CBS*

$$VA = OV - IC - IT \quad (1)$$

$$OV = GP + ES + ISR + SI + ORS \quad (2)$$

$$IC = RM + FEG + RBME + IS + RCR + OE \quad (3)$$

3.2.2. *Input output analysis by Gultom*

$$VA = OV - IC \quad (4)$$

$$IC = RM + RC + AC \quad (5)$$

$$OV = OV_{pr} \times Pr \quad (6)$$

3.2.3. *Input output analysis by Aoudji*

$$VA = TR - TC \quad (7)$$

$$TR = \Sigma Re_i \quad (8)$$

$$TC = MC + T_pC + BC + Rm \quad (9)$$

3.2.4. Rucker plan method. Increasing value added is the objective of the Rucker Plan. When there is an increase in value added, a fixed percentage of that increase is paid out as a bonus. This bonus is given to the employee, since they contributed to the increase. Value added is commonly used in measures of an organization's productivity. It represents the wealth created through its production process or provision of services. Wealth is generated by the combined efforts of those who work in the organization (employees) and those who provide capital (employers and investors). It must therefore be distributed among them. Figure Formulation 10 to 13 provides mathematical equation of Rucker Plan approach [10].

$$VA = Pr + (Lc + Dp + I + T) \quad (10)$$

$$Pr = GsB + Di + RE \quad (11)$$

$$S = VA + Pc \quad (12)$$

$$Pc = Rm + Ut + Rt \quad (13)$$

3.2.5. *Tololiu's value added method*

$$GVA = EVP - TC \quad (14)$$
$$TC = MC + SMC + LC \quad (15)$$
$$NVA = GVA - DV \quad (16)$$
$$DV = (B_gV - B_lV)/(EV) \quad (17)$$

3.2.6. Hayami method. Calculation of value-added through Hayami method [8] in this study is summarized from a number of studies. Formulation 18 presents mathematical equation of Hayami method, while Table 1 presents calculation procedure of Hayami method.

$$VA = f[P, M, L, W, Po, Pm, O] \quad (18)$$

Table 1. Procedure of Hayami value-added calculation.

No.	Variabel	Value
Output, Input, Cost		
1	Output (Kg)	(1)
2	Material (Kg)	(2)
3	Direct labour (WDP)	(3)
4	Conversion factor	(4) = (1) / (2)
5	Coefficient of direct labour	(5) = (3) / (2)
6	Price of output	(6)
7	Wages of direct labour	(7)
Revenue and profit		
8	Material cost (IDR/Kg)	(8)
9	Other input cost (IDR /Kg)	(9)
10	Output value (IDR /Kg)	(10) = (4) x (6)
11	a. Value-added (IDR /Kg)	(11a) = (10) – (8) – (9)
	b. Value-added ratio (%)	(11b) = (11a) /(10) x 100
12	a. Revenue of direct labour (IDR /Kg)	(12a) = (5) x (7)
	b. Share of direct labour (%)	(12b) = (12a) / (11a) x 100
13	a. Profit (IDR /Kg)	(13a) = (11a) – (12a)
	b. Level of profit (%)	(13b) = (13a) /(10) x 100
Responds to the owner of the factor of production		
14	Margin (IDR/Kg)	(14) = (10) x (8)
	a. Revenue of direct labour (%)	(14a) = (12a) / (14) x 100
	b. Donation other input (%)	(14b) = (9)/(12a) x 100
	c. Agro-industry profit (%)	(14c) = (13a) / (14) x 100

3.2.7. Modified Hayami method approach. There was only one previous research discovered performed value-added calculation with Hayami method approach [9]. Table 2 shows a procedure of modified Hayami calculation method.

Table 2. Procedure of modified Hayami calculation method.

No.	**Variable**	**Unit**	**Value**
1	Price of material	IDR/kg	(1)
2	Price of product	IDR /kg	(2)
3	Total of value-added per kg output	IDR /kg	(3) = (the latest 2) – (1)
4. Output, input, and price			
4	a. Output (sales volume)	Kg	(4a)
	b. Output (sales value)	IDR	(4b)
5	Basic raw material	IDR	(5)
6	Direct labour	WDP	(6)
7	Conversion factor		(7) = (4b) / (5)
8	Coefficient of direct labour	IDR /WDP	(8) = (4b) / (6)

9	Wage of direct labour	IDR	(9)
5. Revenue and value-added			
10	a. Other input cost (production)	IDR	(10a)
	b. Other input cost (operational)	IDR	(10b)
11	a. Value-added	IDR	(11b) = (4b) – (5 + 10a + 10b)
	b. Value-added ratio	%	(11b) = (11a) / (4b)
6. Responds to the owner of the factor of production			
12	Margin	IDR	(12) = (4b) – 5
	a. Share of other input cost	%	(12a) = (10a + 10b) / (12) * 100%
	b. Agro-industry profit	%	(12b) = (11a) / (12) * 100%
IV. Value added portion per kg product			
13	a. In currency	IDR	(13a) = (11a) / (∑11a) *3
	b. In percentage	%	(13b) = (13a) / (3) * 100%
	c. Value-added each farmer	IDR /month	(13c)

4. Results and discussion

4.1. Supply chain descriptive analysis of kenaf fibre agroindustry

Supply chain descriptive analysis of kenaf fibre agroindustry was performed using a developed Lambert and Cooper approach [4]. A chart of the descriptive analysis is shown in Figure 2.

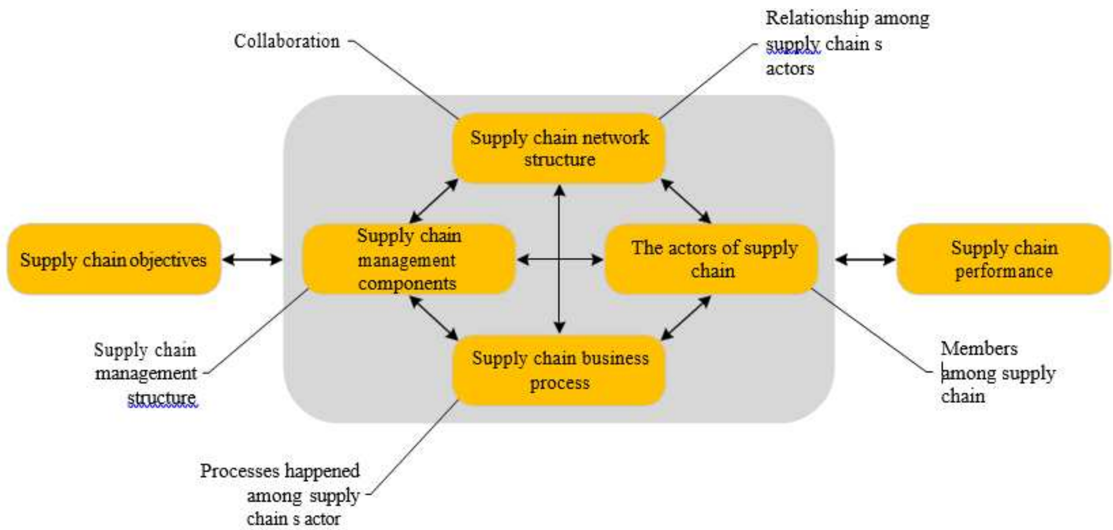

Figure 2. Developed descriptive analysis of supply chain.

4.1.1. Structure of supply chain network. Supply chain network of kenaf fibre agroindustry encompasses upstream, midstream, and downstream industries. Upstream industries are those cultivating kenaf plants from seeds and harvesting them into dried kenaf fibre. Midstream industries are those processing dried kenaf fibre commodity into semi-finished goods that will be further processed into advanced products. Examples of these industries are composite material industries whose raw materials are fibres from bast or core of kenaf stem, and spinning industries whose raw materials are kenaf bast fibre. Downstream industries in the supply chain of kenaf fibre agroindustry process semi-finished goods obtained from midstream industries into panel door trims in automotive interior industries, or into woven fabric in textile industries. The supply chain network of agroindustry is as shown in Figure 3.

4.1.2. Supply chain actors. Actors in the natural fibre agro-industry supply chain in the upstream, middle and downstream networks are agricultural workers, retting farmers, agricultural managers, suppliers, distributors, medium industries, downstream industries, and investors.

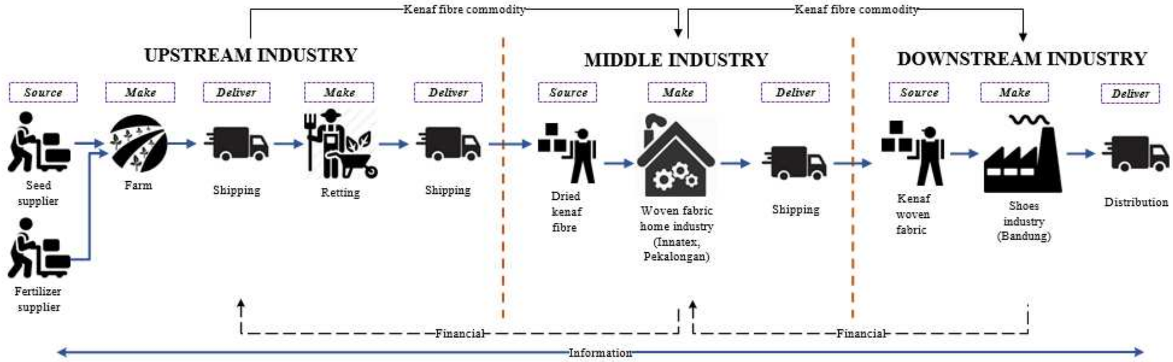

Figure 3. Supply chain network model of kenaf fibre.

4.1.3. Business process in the supply chain. A distribution process occurs from seed suppliers to farm managers, in shipment of dried kenaf fibre, and in shipment of downstream kenaf products. Distribution of downstream kenaf products for an export purpose is executed using expedition services. Downstream kenaf products, such as shoes product, are transported using minibus.

4.1.4. Supply chain management. Selection of fertilizer suppliers is currently carried out directly by farm managers, while seeds are only provided from Balittas and PT XYZ. Financial transaction system between farm managers and producer is based on an agreement letter called as Purchase Guarantee Letter. It is contained in this letter that PT XYZ is willing to purchase dried kenaf fibre of grade A, B, and C, at agreed-upon prices. Financial transaction system between suppliers of dried kenaf fibre and woven fabric industries is based on a purchase letter, and payment is completed by transfer to a designated bank. The information system currently applied is still limited to communication requirement in forms of email, short message, and social media, such as Whatsapp messenger. Furthermore, an information system that is able to facilitate collaboration performance between suppliers and buyers to achieve efficiency in production and inventory cost, as well as optimization in profit sharing between these two parties has not existed.

4.2. Value added analysis

4.2.1. Variable cost

Table 3. Consumable cost.

No	Description	Quantity	Unit	Price (IDR)	Total price (IDR)	TOTAL (IDR)
1	Kenaf seed KR 11	8	kg	45,000	602,000	
2	Organic fertilizer	100	sack	15,000	1,500,000	
3	NPK and puliser	2	set	500,000	1,000,000	3,102,000

Table 4. Labour cost.

No	Description	Quantity	Unit	Price (IDR)	Total Price (IDR)	TOTAL (IDR)
1	Clearing	32	WDP	50,000	1,600,000	
2	Planting and fertilizing	40	WDP	50,000	2,000,000	
3	Harvesting	24	WDP	50,000	1,200,000	
4	Soaking	16	WDP	50,000	800,000	

5	Flipping	16	WDP	50,000	800,000	
6	Retting and drying	48	WDP	50,000	2.,400,000	
7	Ribbonner machine operator	8	WDP	50,000	400,000	
8	Chopper machine operator	8	WDP	50,000	400,000	
9	Crusher machine operator	8	WDP	50,000	400,000	6,400,000

Table 5. Machine operational cost.

No	Description	Fuel requirement/ electricity	Unit	Price (IDR)	Cost (IDR)
1	Ribbonner machine maintenance cost	5% price = 5% (IDR17,161,800)			858,090
2	Ribbonner machine fuel cost	12.44	liter	9,800/liter	121,910
3	Ribbonner machine depreciation cost	5% price and economic age (5 year)			3,260,742
4	Chopper machine maintenance cost	5% price = 5% (IDR10,000,000)			500,000
5	Chopper machine electricity cost	69.7	kWH	1,467/kWH	102,328
6	Chopper machine depreciation cost	5% price and economic age (5 year)			1,900,000
7	Crusher machine maintenance cost	5% price = 5% (IDR28,603,000)			1,430,150
8	Crusher machine electricity cost	131.2	kWH	1,467/kWH	192,551
9	Crusher machine depreciation cost	5% price and economic age (5 year)			5,434,570
				TOTAL (IDR)	15,000,341

4.2.2. Value added determination. The value added analysis of the seven methods is presented in Table 7, only 1 method that calculates the added value in terms of gross value added and net value added, namely Tololiu's value added method [11]. Gross value added is the difference between the acquisition of product sales and total costs, which in total costs consist of material costs, supporting material costs, and labor costs. While net value added is the difference between gross value added and depreciation value.

In this study, there are two methods for determining the value added which include tax variables. The two methods are Input output analysis by CBS [5], and Rucker plan method [10]. Indirect taxes are taxes applied when the collection is charged to other parties. Consequently, the person in charge of tax administration and taxpayers is a different person. Indirect taxes can also be defined as taxation on individuals or entities that are ultimately paid by others. The body that collects the tax will then send it, or report it to the government [26].

Other methods do not include the tax variable in determining the added value, and it can be caused by the tax being included in the price of the product as done by Gultom [6], product sales revenue as done by Aoudji [7], determination of product output carried out on the Hayami method, and the determination of output (sales value) made on the Modified Hayami method [9].

Table 6. Comparison of Value Added criteria in Value Added Method.

Method	Analysis of comparisons	Contributions
Input output analysis by CBS [5]	CBS considers tax as an important variable that must be included in determining the value added, even though the value entered does not become a direct income, because it must be paid to the tax institution. Tax is a real variable that must be issued by industry, therefore this method is representative to determine the value added of kenaf fibre for agro-industries in the upstream, intermediate, and downstream supply chain networks	This method contributes to the calculation of industrial value added in macro. Nevertheless, this method can be applied to determine the added value of one type of industrial company

Input output analysis by Gultom [6]	This method is considered to be very realistic in defining the added value of a product, but if we explore how costs are defined, there is no definitive guide. So that each researcher can use according to their needs tailored to the situation and conditions, without having to mention the name of the variable	This method provides a very general value added calculation, so that it can be applied to calculate the value added in a macro perspective
Input output analysis by Aoudji [7]	The same implication also occurs for the input output analysis method used by Aoudji, as well as Gultom. The only difference lies in the name of the variable. Therefore this method is considered to be less representative to be applied to the calculation of the value added network of upstream, medium and downstream supply chains in kenaf fibre agro-industry	This method is relatively more flexible if it is to be applied for the determination of value added in a macro or micro perspective
Hayami method [8]	The added value of the Hayami method is strongly influenced by the conversion factor which is the yield value of the product derived from the raw material. The higher the total prdxoduct output, the higher the conversion factor, and is directly proportional to the added value. The opposite condition applies. Thus, to get high value added, agro-industry must produce as much production as possible	This method generates the contribution of labour to value added. This method provides the results of figuring value added on a micro scale, specific to one type of product produced by an industry
Modified Hayami method [9]	The modified Hayami method has two output values, namely output from sales volume, and output from sales value. This method is considered less representative because it turns out that of the two output values, only one output value affects the added value, namely the output of sales value. The value added here will affect the value of the company's profit. The higher the sales value output, the higher the company's margins and profits. Therefore, kenaf fibre agro-industry must produce the maximum amount of kenaf dried fibre products, and woven fabric.	This method determines that labour contributes to the value added, in detail and specifically for each product variation in an industry and in each supply chain actor
Rucker Plan method [10]	The value added of the Rucker plan is influenced by the labour cost included as an input cost criterion. The depreciation value here can be interpreted as the depreciation of a building or engine, but it becomes a complete variable, when the depreciation cost of the engine is not accompanied by the cost of fuel or electricity for the engine. Therefore, this method is considered not representative for use in the value added of kenaf fibres in the upstream, intermediate and downstream supply chain of kenaf fibre	This method determines the contribution of labour to the value added of an industry
Tololiu's value added method [11]	As well as Rucker plan, Tololiu included the value of depreciation, but did not clearly define the input costs of fuel or electricity as did the input output analysis by CBS. In addition, this method also does not define the inventory of raw materials, WIP, and products in the beginning and ending in determining the gross value added associated with inputs. Thus, this method is not used to determine the value added of kenaf fibres in the upstream, intermediate, and downstream supply chain of natural fibre agro-industry	This method is relatively more specific to be applied in an industry that produces a certain product to determine its value added

When viewed from the depreciation side of the determination of value added, the Rucker Plan method [10] includes the depreciation variable. While Tololiu [11] included the depreciation variable in the determination of net value added. In the Hayami method and the Modified Hayami method [9], the depreciation variable is not included in the determination of value added, and it is possible because the depreciation cost can be included in other input contributions or other input costs (operational) in the Modified Hayami method [9]. Depreciation variable also does not appear in the determination of value added Input output analysis by Gultom [6] and Input output analysis by Aoudji [7] because it is very possible if the depreciation value has been included in the intermediate cost calculation by Gultom [6], and at the total cost by Aoudji [7].

Based on the analysis and description of the implications above, to determine the added value of kenaf fibres in the upstream industry into woven fabrics in the intermediate industry, then to shoes in the downstream industry, the input output by CBS analysis method [5] is determined. This is because this method is considered to be very realistic in determining the output value of a product, by putting it with the income tax value from product sales. The tax charged is 10%, and must be paid by the agro-industry to the tax institution.

This method also considers the importance of inventory management, so inventory variables at the beginning and ending are included in the input criteria. Of course, inventory will greatly affect the value added of kenaf fibre. The higher the cost of inventory, the lower the value added of kenaf fibre. Therefore, inventory costs must be set to a minimum.

Kenaf fibre agro-industry supply chain will not be spared from industrial services that can guarantee the creation of value added of kenaf fibre. The industrial service used by kenaf fibres is the transportation of kenaf plants from the farm to the retting location. This is done because the kenaf farms in Cibiuk Garut Regency are not located in watersheds. Therefore, it must be moved for the retting process. The kenaf fibre agro-industry supply chain will produce a by-product that has the value added of the kenaf plant. The intended by-product is the stem core, which can be processed into kenaf core chips and kenaf core powder. At present, dried fibre producers have not yet processed this product, because it is still constrained in marketing issues. This is the reason for the importance of other revenue variables from non-industrial services.

This method has several variables that are defined in a representative manner for the kenaf fiber agro-industry supply chain on the input criteria such as diesel fuel used for machinery, and gasoline fuel used by the woven fabric industry for the transportation process of transferring kenaf dried fibre from Cikutra Bandung to the Home industries in Pekalongan. Electricity costs will also be used as energy generating chopper machines and crusher machines to produce kenaf core chips and kenaf core powder.

4.3. Value added of kenaf fibre in supply chain network

4.3.1. Value added of kenaf fibre in upstream supply chain network. The input criteria for kenaf dried fibre is IDR23,742,742. The first cost comes from the purchase of raw materials as much as 8 kilos for 1 hectare of land at a price of IDR45,000/kg which includes packing and shipping costs from Malang to Cibiuk Garut Regency, so the total is IDR602,000. The second cost is the cost of renting land and operating costs for the machine, with a value of IDR10,240,742. The third cost is the transportation cost of moving the post-harvest kenaf plants to the retting location using a 6-ton capacity truck, with a value of IDR1,200,000. The fourth cost that must be incurred is other costs, which consist of the cost of purchasing fertilizer and labour amounting to IDR11,700,000. The output criteria are obtained from the sale of 4,400kg of kenaf dried fibre at a price of IDR25,000/kg. The output produced by kenaf dried fibre is IDR110,000,000. Therefore, the value added of kenaf dried fibre is IDR75,257,258. This is subject to 10% agroindustry tax.

Currently, upstream industries that carry out retting do not utilize kenaf stem core, while kenaf stem core can actually be processed into kenaf core chips and kenaf core powder which can be used as composite fillers, kenaf boards, army clothing, helmets, wood materials, and building construction materials [34]. Therefore, at present, kenaf stem core is a by-product. If kenaf stem core is produced, it will be included as output criteria for the other revenue from non-industrial services variable. The value that can be obtained is IDR84,725,619 with a product output of 4,400 kg and a cost of goods sold of IDR10,590/kg. So that there will be an increase in the value added of kenaf fibre in the upstream supply chain amounting to IDR159,982,877 (112.58%).

4.3.2. Value added of kenaf fibre in intermediate supply chain network. The input value for woven fabric is IDR283,282,000 with the use of material as much as 6,000kg dried kenaf fibre at a price of IDR25,000/kg. There are transportation costs in the form of moving kenaf dried fibre from Cikutra bandung to Pekalongan using a minibus owned by the company, so the costs incurred are the cost of fuel and the wages of a driver and his assistant, the fee is IDR655,000. There is also the cost of industrial services using makloon services, which are carried out by 55 home industry weavers in Pekalongan in the amount of IDR126,750,000. Finally, another expenditure of IDR5,877,000 is spent on the distribution of woven fabrics to Jakarta, Bandung, Solo, Yogyakarta and Bali. The output obtained from the sale of 6,000 pieces of woven fabric for IDR250,000 per sheet is IDR1,500,000,000. Therefore, the added value of woven fabric is IDR1,066,718,000. It excludes a 10% income tax imposed on woven fabric products, which must be paid by the company to the tax government authority.

4.3.3. Value added of kenaf fibre in downstream supply chain network. The processing of kenaf dried fibre into woven fabric in the intermediate supply chain for downstream industries is produced into apparels, shoes and bags with high selling prices for the middle and premium market segmentation. This shoe industry is located in the city of Bandung. The production process is done manually and hand made without the aid of a machine, only with the handling of the operator. And very minimal use of chemicals such as glue or coloring in the production process. Marketing of its products is done by doing official shops and online shops. In fact, this product has been exported to Malaysia, Singapore, the Philippines, Europe, the United States, Hong Kong, and Japan. Production variations are 14 shoe variations, with selling prices of IDR650,000 to IDR1,200,000. This means an increase in the added value of woven fabric in the intermediate industry to shoe products in the downstream industry by IDR400,000 (160%), an increase in value added from kenaf fiber in the upstream industry to shoe products in the downstream industry by IDR625,000 (2,500%).

Based on the description related to the increase in value added that occurs in the downstream industry, it appears that there is enormous potential and opportunity for the superiority of kenaf fibre to be developed in this country. Judging from the limited land, it has been approved by the government to pay attention to these competitors. Because it was stated by the ministry of industry that Indonesia is ranked fourth as a footwear producing country in the world [27].

The limitation of this research is the lack of literature related to value added that should be able to be deepened further. In addition, it is still possible to compare several methods of value added analysis that have been carried out by previous researchers to be criticized for its approach. Last is related to the value added of kenaf fibre, that there is still limited access that can be managed to document data in the downstream industry. The results of production in the downstream industry can be explored by other products such as apparel or bags which are the needs of the community that is sustained as long as humans live in the world.

The Hayami method is a very specific method applied for detailed product variations. Therefore, further research that will be carried out is developing the Hayami method by adding tax variables, inventories, by- products, and adding industrial service input variables. In addition, what will be done is to optimize the acquisition of data in the downstream industry for the processing of woven fabrics into a pair of shoes or other downstream products that have an export market share and are competitive with imported products.

5. Conclusion

In this study of the supply chain of kenaf agro-industry in upstream, intermediate and downstream networks, it is determined that the input output analysis by CBS method is the most representative method for kenaf fibre agro-industry. The value of the calculation of value added for kenaf dried fiber is IDR75,257,258 and for woven fabric is IDR1,066,718,000. The kenaf stem core which is currently a by-product has an added value of IDR10,590/kg to be produced into kenaf core chips and kenaf core powder, which can increase the added value of kenaf dried fibre to IDR159,982,877. Added value is greatly influenced by costs caused by changes in raw materials to finished products and labor contributions. First recommendation in this study is the government should conduct assistance, and publish policies that support the potential of kenaf fiber. The second recommendation is that the government should facilitate the development of cultivation and marketing of kenaf products. This is solely to increase the value added and competitiveness of kenaf fibre at the national and global level.

6. References

[1] Santoso B, Jami A H and Machfud M 2016 Manfaat kenaf (*Hibiscus cannabinus* L.) dalam penyerapan karbondioksida (CO_2) *Perspektif* **14** 125–33.
[2] [FAO] Food and Agriculture Organization 2016 Jute, kenaf, sisal, abaca, coir and allied fibres – Statistics December 2015 *FAO* 1–40.
[3] Kementerian Perindustrian 2018 Making Indonesia 4.0 Jakarta.
[4] Van der vorst J, Silva da C and Trienekens J 2007 Agro-industri supply chain management: concepts and applications Rome.
[5] [BPS] Badan Pusat Statistik 2015 Statistik Industri Manufaktur Indonesia 2015 Jakarta.
[6] Gultom R M 2012 Pengaruh produktivitas lahan dan nilai tambah terhadap daya saing komoditas minyak kelapa sawit indonesia *J. Ekon. Pembang*. **10** 82–103.
[7] Aoudji A K N, Adégbidi A, Akoha S, Agbo V and Lebailly P 2012 Value added and equity in the smallholder-produced Teak (Tectona grandis L . f .) poles value chain in Southern Benin *Tropicultura* **30** 55–60.
[8] Hayami Y, Kawagoe T, Morooka Y, and Siregar M 1987 Agricultural marketing and processing in upland Java a perspective from a Sunda village 8 Bogor: The CGPRTCentre.
[9] Hidayat S, Marimin, Suryani A, Sukardi and Yani M 2014 Modifikasi metode hayami untuk perhitungan nilai tambah pada rantai pasok agroindustri kelapa sawit *J. Teknol. dan Manaj. agroindustri* **22** 22– 31.
[10] [NTUC] National Trade Union Congress 2011 A guide to productivity gainsharing Singapore: Spring Singapore.
[11] Tololiu M S, Pangemanan P A and Pakasi C B D 2016 Analisis nilai tambah bunga potong krisan pada Ningsih florist di Kota Tomohon *Agri-sosioekonomi* **12** 133–42.
[12] Walters D, Halliday M and Glaser S 2006 Added value, enterprise value and competitive advantage *Manag. Decis.* **40** 823–33.
[13] Festerling P 2008 Value added in the Danish food processing industries *Food Econ. - Acta Agric. Scand. Sect. C* **5** 37–41.
[14] Stevenson G W and Pirog R 2013 Values-based food supply chains: Strategies for agri-food enterprises- of-the-middle, National Institute for Food and Agriculture of the Cooperative State Research, June 1– 9.
[15] Adeniyan O N 2018 Adding value to kenaf : panacea for economic diversification II *J. Exp. Agric. International* **27** 1–9.
[16] Hannum A, Damayanti Y and Elwamendri 2013 Analisis komparasi nilai tambah produk olahan nenas pada agroindustri di Kabupaten Muaro Jambi *Surya Agritama* **2** 10.
[17] Syarif M S H M, Rauf R A and Howara D 2018 Analisis nilai tambah abon sapi pada industri rumah tangga mutiara haji Mbok Sari di Kota Palu *e_Journal Agrotekbis* **4** 370–6.
[18] Rizqiah F 2013 Analisis nilai tambah dan penentuan metrik pengukuran kinerja rantai pasok pepaya calina IPB.
[19] Miftah H, Yoesdiarti A and Maulana M 2018 Analisis nilai tambah olahan gula aren di kelompok usaha bersama (KUB) gula semut aren (GSA) *J. Agribisains* **4** 8–14.
[20] Djunaidi M, Surakarta U M, Setiawan E and Surakarta U M 2019 Analisis nilai tambah produk olahan ketela ungu dan rantai pasok ketela ungu *J. Ilm. Tek. Ind.* **17** 151–7.
[21] Anwar, Dipokusuma B, Suparmin and Hamidi H 2019 Nilai tambah agroindustri pengolahan komoditas pangan unggulan di Kecamatan Selaparang Kota Mataram *J. Abdi Mas TPB* **1** 37–45.
[22] Dewi K H, Nusril, Helmiyetti. Rosalina Y and Sarumpaet P 2013 Analisis nilai tambah kopi teripang jahe pra campur saset *AGRISEP* **12** 209–16.
[23] Marimin M, Djatna T and Permana I G 2016 Kinerja rantai pasok dan nilai tambah dengan internalisasi aspek lingkungan pada agroindustri ayam ras pedaging *J. Teknol. Ind. Pertan.* **26** 312–20.
[24] Kodrat K F, Sinulingga S, Napitupulu H and Hadiguna R A 2018 Value added analysis of

agroindustry supply chain passion syrup in North Sumatera Province *Int. J. advenced Res*. **6** 713–20.
[25] Hidayat K, Yaskun M and Prasnowo M A 2018 Value added analysis of water hyacinth bags as regional featured product *Eng. Sains J.* **2** 115–8.
[26] Maulida R 2018 Pengertian pajak tidak langsung Aplikasi online pajak [Online] Available: https://www.online-pajak.com/pajak-tidak-langsung [Accessed: 25-Sep-2019].
[27] Wibawaningsih G 2019 Produksi industri alas kaki RI pijak posisi 4 dunia, Ditjen IKMA [Online] Available: https://jpp.go.id/ekonomi/industri/331615-produksi-industri-alas-kaki-ri-pijak-posisi-4- dunia [Accessed: 01-Oct-2019].

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