ISSN No:-2456-2165

Pilot Project Development of Oil Palm Trunk Wood Industry

Marzolina, S.E., M.M. (*Author*)
Lecturer, Faculty of Economics and Business
Affiliation: Faculty of Economics and Business, University of Riau, Jl. Binawidya Km 12.5, 28291, Pekanbaru Riau, Indonesia.

Arwinence Pramadewi, S.E., M.M.
Lecturer, Faculty of Economics and Business
Affiliation: Faculty of Economics and Business, University of Riau, Jl. Binawidya Km 12.5, 28291, Pekanbaru Riau, Indonesia

Dr. Samsir, S.E., M.Si.
Lecturer, Faculty of Economics and Business
Affiliation: Faculty of Economics and Business, University of Riau, Jl. Binawidya Km 12.5, 28291, Pekanbaru Riau, Indonesia

Dr. Aida Nursanti, M.M.
Lecturer, Faculty of Economics and Business
Affiliation: Faculty of Economics and Business, University of Riau, Jl. Binawidya Km 12.5, 28291, Pekanbaru Riau, Indonesia

Abstract:- Wood is a material composed mostly of cellulose (40-50%), hemicellulose (20-30%), lignin (20-30%) and a small amount of inorganic and extractive material (Dumanauw, 1990). Accordingly, wood has hydrophilic, hard, and biodegradable. Until now, there is no utilization of oil palm waste in a significant amount since it is tender and has high-water content. Generally, oil palm trunks are left to rot in the open field. The objective assessment of pilot project processing oil palm into wood/ composite particleboard is to present how the technology of oil palm trunk waste is processed as raw material (input) into the composite pane board (output) which can create economic value. Definition experiment with sample treatment in BPPT Serpong Jakarta generated the results seen from the density particleboard with the reference of SNI - 03-2105-2006 is between 0.4 up to 0.9 g/ cm3. The measurement results of all samples in the laboratory in this activity stated that Phenol Formaldehyde adhesive type reached the density of 0.702 g/ cm3; with Acrylic 0.72 g/cm3 and the use of unsaturated polyester type obtained the density of 0.892/cm3. The third test sample showed endurance in the base situation because there is no change in the form of delamination, blistering, rupture, and softening. These figures show that the use of the three types of adhesive density particleboard produced is SNI qualified. The next three test samples showed endurance in the base situation because there is no change in the form of delamination, blistering, rupture, and softening.

Keywords:- *Palm Trunk Processing Technology into Particleboard.*

I. INTRODUCTION

The effort of striving the regional development objectives nowadays is faced with various challenges compared to the era before globalization. The first challenge is related to the external condition as the impact of mobility liberalization of resources and investment as well as foreign trade threats which are immensely competitive. The second one is related to the internal condition which reflects the domestic micro and micro condition changes, such as the dynamics of economic structure transformation, spatial and sectoral migration, land resource availability, investment and per modal ability, human resource adaptive ability with Information technology development, culture, and such.

The role of agricultural sector in the Indonesian economy is getting more significant, mainly in state foreign exchange receipts through export activities, job vacancy provision, domestic consumption need fulfillment, raw material resources of various domestic industries, the creation of added value and competitiveness as well as the optimization of sustainable natural resources management. The role of plantation subsector for the national economy is reflected from the PDB plantation added value cumulatively experienced an increase in 2005-2010 which grew 19.3% per year on average.

Many forest areas are converted into plantations, including oil palm plantation which has a high economic value and can produce in a relatively short time. The surge of plantation development mainly oil palm plantation is one of the causes of deforestation.

The development of oil palm plantation does not only contribute positively to the society and country but also has negatively. One of the negative impacts of oil palm plantation activities, originating from oil palm waste, such as oil palm trunks, fronds, and leaves. Oil palm trunks generated from the logging due to regeneration can cause problems to farmers, because the unattended or unplanted waste has potential to increase beetle pest population which will threaten and trigger the damage of the oil palm leaves, mainly attacking the oil palm shoots and can cause death to the oil palm.

One of the alternative efforts to minimize the negative effects to support the sustainable oil palm plantation sustainably is to further processing of plantation and oil palm waste becomes economic value, for example: some of the plantation waste such as oil palm leaves, fronds, and trunks can be processed further and create double positive impact, which is creating economic value and minimizing the negative impacts of pollution and pest population attack on

ISSN No:-2456-2165

oil palm trees. This effort needs to be made because the big number of oil palm trunks can be generated from replanting oil plant trees.

From the research background description, it is formulated the research problems on how the technology of oil palm trunk waste processing as raw material (input) becomes composite panelboard (output) can create economic value and whether the processing of oil palm trunks into composite panelboard can generate competitive quality output and can be one of the alternative references in developing oil palm waste-based agroindustry business.

The objectives of the initial study of pilot project of processing oil palm trunks into wood to composite board are to study the potentials of oil palm tree trunk raw materials in Kampar Regency as well as to find out the socio-economy description of oil palm farmers as human resources who are expected to involve directly in the pilot project of processing oil palm trunks into wood/ composite board, conducting introduction to technology innovation of composite panelboard manufacturing with economic value from oil palm trunk waste, producing composite board/ wood from the results of oil palm trunk waste processing and conducting the quality test of composite panel products from oil palm trunk waste.

II. THEORETICAL REVIEW

➢ *Oil Palm Waste*

Oil palm trees (Elaeis guineesis) are monocot plants which do not have vascular cambium. Generally, oil palm trunks consist of the epidermis, ground parenchyma, and vascular bundle layers. Epidermis is the outer part which functions to protect the inside part of the trunk. Besides that, epidemic also has a function to prevent water evaporation from the trunk as well as having holes for gas circulation in the perspiration and photosynthesis processes.

The utilization of oil palm trunks as tropical wood substitution has an excellent environmental aspect concerning the national and international efforts to preserve tropical forest (Balfas, 2003).

➢ *Composite Wood Products*

Composite product is the product using the wood or other berlignocellulose materials as the main materials. Rustamiadji (2008) states that wood composite is a term describing every product made of layers or small pieces of wood stuck together.

Hakim (2007) states that basically composite can be defined as the mixture of macroscopic of fiber and matrix. Fiber is a material which is much stronger than matrix and functions to give pull strength. Meanwhile, the matrix has a function to protect fiber from the environmental effect and damage due to jolts.

III. RESEARCH METHODOLOGY

➢ *Research Location*

The research setting was determined based on its relationship with the research object, which was in Kampar Regency. It has the second largest communal oil palm plantation in Riau Province with the area of 190.016 hectares, or 14.45% out of the area of 1.315.231 hectares of the communal plantation of Riau Province, which is spread across 21 districts consisting of 88,692 householders (KK). The selected locations were Perhentian Raja District, Gunung Sahilan District, and Tapung District. Meanwhile, the laboratory analysis was conducted in the laboratory of Center of Polymer in Agency for the Assessment and Application of Technology (BPPT). These research activities were conducted for 5 (five) months including preparation, implementation and activity reports construction which was in June until November 2014.

➢ *Research Design of wood-alternative product made of Palm trees*

The development activities of wood-alternative product from oil palm trunks were conducted in three main stages, which were initial treatment experiment on oil palm trunk, the experiment of the wood-alternative product, and performance test of the wood-alternative product as the result of development.

➢ *Socio-economy Research Design*

Socio-economic research was performed using the survey method and direct interview technique and using a questionnaire distributed to the respondents (farmers) in three district location samples.

➢ *Research Variables*

Several research variables observed were the variables related to the use value creation technology innovation of oil palm waste to produce output in the form of composite panelboard and the cost of production of composite panelboard.

Furthermore, it is in the form of response variable which would support the further action of oil palm trunk waste processing development into composite panelboard commercially on the active role of the oil palm farmers to improve people's economy, particularly the oil palm farmers in the research setting. Furthermore, it the support of the institutional factors, infrastructure, and governmental supports were observed. For this study, primary and secondary data were needed by using the research method.

➢ *The Stages of Information/Data Collection*

On the stage of preliminary study preparation, survey activity was conducted to perform the study on the socio-economy condition of oil palm farmers in Kampar Regency and the internal strengths/weaknesses of oil palm farmers. Motivation and skills owned in developing the oil palm plantation business. Besides that, opportunity and market chance studies were conducted on the composite panelboard produced from the oil palm trunk material, including the cost of production and competitiveness in the market.

➢ *Types and Needs of Research Data*

The collected data were categorized into the primary data and secondary data. The primary data were focused by conducting interview and observation on oil palm farmers and related institution. Meanwhile, the secondary data were obtained from the village-level; governmental institution, and the related institutions namely: Department of the plantation, Department of industry, and department of trade.

➢ *Techniques for Determining Samples and Study Areas*

The research setting was determined based on the relationship of the setting with the research object which was in Kampar Regency. It has the second largest communal oil palm plantation in Riau Province with the area of 190,016 hectares or 14.45 % of the total area of 1,315,231 hectares of communal plantation in Riau Province spread across 21 districts which consist of 88,692 householders (KK).

The population of this research was the overall oil palm farmers in Kampar Regency. The determination of the sampling technique was using multistage, which was by determining the district samples and householder samples (KK) of oil palm farmers as the respondents.

No	Number of Householders	Number of Districts	Samples	
			Districts	Number of Householders
1	< 5000	16	Perhentian Raja	30
2	5000-10,000	2	Gunung Sahilan	30
3	>10,000	3	Tapung	40
		21		100

Table 1:- THE DETERMINATION OF DISTRICT SAMPLES AND THE NUMBER OF HOUSEHOLDERS OF OIL PALM FARMERS
Source : Researcher's Processed Data

➢ *Data Collection Technique*

Data collection, especially primary data was conducted by interview and observation techniques simultaneously. The interview was intended for the respondents who were believed as an individual who understood themselves and the palm plantation according to the requirement of purposive random sampling technique which has been stated previously.

➢ *Data Analysis Technique*

The type of data collected in this study were primary and secondary data. Primary data include the results of the interview with experts and practitioners involved in the development of oil palm trunk material processing agroindustry for composite panelboard production. The secondary data were obtained by performing literature study as well as the document source of the related institution and the economic agents. The development analysis used Analysis Hierarchy Process (AHP) method (Saaty, 1993), the selection of institution used Exponential Comparison Method (ECM)

➢ *Stages of Demonstration and Awareness Development*

The demonstration activity of composite panelboard production using oil palm trunk material involved experts from BPPT Jakarta with the participants were oil palm farmer householders who became the respondents in each sample district. The number of participants was 30 farmers, 10 farmers representing each district.

➢ *Demonstration Activity Setting*

For demonstration activity of composite panelboard production made of oil palm was conducted in BPPT Jakarta Laboratory by assigning the oil palm farmers representatives of the research setting sample districts.

➢ *Participants*

Oil palm farmers selected as the representatives were one farmer for each district and attended by Research and Development Team (Balitbang) Riau province, researcher team of Faculty of Economics Universitas Riau.

➢ *Experts*

The experts who conducted the demonstration of composite panelboard production were the expert team from BPPT Serpong Jakarta.

➢ *The Stages of Learning and Operational Demonstration of the Technology*

Learning instruments, learning media (Slide), equipment, Infocus projector, laptop, Infocus screen, and instructor.

➢ *General description of the Research Setting*

This research consisted of two main parts, which were research with observation and socio-economy survey research on oil palm farmers in Kampar Regency, accordingly, both studies were different.

➢ *Geographic and Topographic of the Study Area*

As previously stated, the research setting was determined based on the relation of the region of the research objects, which was in Kampar Regency which has the second largest communal oil palm plantation in Riau Province as much as 190.016 hectares or 14.45 % out of 1,315,231 hectares of the communal plantation in Riau Province, spread across 21 districts which consisted of 88,692 householders (KK). Using multistage sampling method started from the determination of Kampar Regency as the research setting, proceeded with the determination of the selected districts until the determination of respondents of householder samples (KK) of oil palm farmers representing the selected districts.

➢ *Forest Use and Distribution of Land Functions*

Regulation of the Minister of Forestry of the Republic of Indonesia Number: P. 50/ Menhut-II/2009 on Affirmation on Status and Function of Forestry Area Land Usage Agreement which then known as TGHK which is the joint agreement of all officials in province level to determine the allocation of forest area with its function which then realized by signing on the map.

IV. DEMOGRAPHY

➢ *Population According to their Origin*

Kampar people call themselves as Ughang Ocu, spread across most part of Kampar region with the tribes such as Domo, Malayu, Piliong/Piliang, Mandailiong, Putopang, Caniago, Kampai, Bendang, et cetera. Historically, ethnically, in terms of custom, and culturally, they are significantly close to Minangkabau people (Purna, I.M., et al.,1997).

➢ *Population Composition Based on Their Livelihood*

Within three years (2009 until 2011), it can be said that there is no significant change of orientation in the people's livelihood of Kampar Regency. It is proven from the data in the table beside where a significant change of job orientation is not presented.

Seen from the structure of the people's livelihood, it is dominated by the livelihood in the field of construction (76.27 %), followed by the livelihood in the agricultural sector 6.80 % and industrial sector 6.33 %.

➢ *Population Composition based on their Religion*

The population composition based on religion in 2009 was dominated by Moslem as much as 93.04 %, followed by protestant Christian citizens 5.73 % and Catholic 1.17 %, the rest was 0.06 % Hindus and Buddhists. The population composition in 2011 experienced a change where Moslem citizens were 90.20 %, protestant Christian 8.97 %, Catholic 0.74 %, the rest was Hindus, Buddhists, Confucius and other belief streams of 0.09 % (BPS, 2012 processed).

➢ *Infrastructure*

In terms of infrastructure (roads), Kampar Regency Government pays adequate attention. It is proven by the addition of road number from 2009 until 2011 which experienced an increase. It includes the roads of regency, province, and state. However, for connecting roads to certain regional locations still need serious improvement, mainly the roads towards communal oil palm plantation which is considered as apprehensive including the road condition which is difficult to pass through, security factor, and such.

➢ *Palm Tree Plantation Potential*

Related to the potential of oil palm trunk waste material which can be processed into composite panelboard product, it is the oil palm tree which has entered cutting age or replanting period. To determine this potential, it is better to be in accordance with the plantation area based on planting age. Since the real data were not provided both from the related oil palm institution and statistics Indonesia, the potential of oil palm trunk material was determined based on the oil palm area based on old-damaged plants/Tanaman Tua Rusak (TTR) obtained from Statistics Indonesia of Riau Province.

NO	**Palm Tree Plantation**	**2011**	**2012**	**2013**
Kampar Regency				
1	Area of Oil Palm Plantation (Ha)	159.964	190.016	190.486
2	Area of Old-Damaged Plants (HA)	54	127	154
3	Percentage (TTR)	0.03 %	0.07 %	0.08 %
Riau province				
1	Area of Oil Palm Plantation (Ha)	2.258.553	2.372.402	2.399.172
2	Area of Old-Damaged Plants (HA)	21.670	10.247	36.551
3	Percentage (TTR)	0.96 %	0.43 %	0.01 %

Table 2:- AREA OF OLD-DAMAGED PLANTS (TTR) IN KAMPAR REGENCY IN THE 2009-2011 PERIOD
Source: The data of Statistics Indonesia of Riau Province (BPS) in 2014

The area of old-damaged plantation which has the potential for raw material in the form of oil palm trunks in 2011 as much as 54 hectares, in 2012 or on average of 4.5 ha per month increased up to 127 hectares and in 2013 reached up to 154 ha, or on average each month the area of oil palm plantation which has the potential to be raw material on average was between,5 ha - 12,83 ha each month. By assuming the number of oil palm trunk is as many as 120 trees per hectare, then the number of oil palm trunks available to be processed was 540 – 1539.6 trunks per month.

➢ *Description of STP BPPT Serpong Laboratory*

This testing was conducted in Polymer Technology Center Laboratory BPPT Serpong Gd. 460 Center for Research in Science and Technology area – Serpong Tangerang 15314 Banten. Agency for the Assessment and Application of Technology (BPPT) is a non-department governmental institution under the coordination of State Ministry of Research and Technology which has the duty to conduct governmental duty in the field of technological studies and applications.

V. RESEARCH RESULTS

A. Results of Socio-Economy Study

Material Potentials

The potential of raw material in the form of oil palm trunk waste each year to proceed polymer particleboard production immensely depends on the number of oil palm trunks which need to be cut during the year needed. The old unproductive oil palm trunks can be utilized into high-valuable products. The oil palm trunks can be made into household furniture material such as furniture or as particleboard. From each oil palm trunk can generate wood as much as 0.34 m3.

No	Palm Tree Plantation	2011	2012	2013
Kampar Regency				
1	Area of Oil Palm Plantation (Ha)	159,964	190,016	190,486
2	Area of Old-Damaged Plants (HA)	54	127	154
Optimistic Scenario of Wood Potential (m^3)		11,880	27,940	33,880
Moderate Scenario of Wood Potential (m^3)		10,800	25,400	30,800
Pessimistic Scenario of Wood Potential (m^3)		8,856	20,828	25,256
Riau Province				
1	Area of Oil Palm Plantation (Ha)	2,258,553	2,372,402	2,399,172
2	Area of Old-Damaged Plants (HA)	21,670	10,247	36,551
Optimistic Scenario of Wood Potential (m^3)		4,767,400	2,254,340	8,041,220
Moderate Scenario of Wood Potential (m^3)		4,334,000	2,049,400	7,310,200
Pessimistic Scenario of Wood Potential (m^3)		3,553,880	1,680,508	5,994,364

Table 3:- POTENTIAL OF RAW MATERIAL FOR PALM OIL PALM TREE WASTE 2011 – 2013 PERIOD
Source: 2014 analysis results based on Statistics Indonesia processed data of Riau Province (2014)

The area of oil palm plantation in Kampar Regency experienced an increase each year including the old-damaged oil palm plantation (TTR). The increase of oil palm plantation within the period of 2011- 2012 was 30,052 ha (18.79 %) and on the following period (2012-2013) increased as much as 470 ha (0.025 %). The area of old-damaged plantation which has the potential for raw material in the form of oil palm trunks in 2011 as much as 54 hectares, in 2012 or on average 4.5 ha per month increased up to 127 hectares and in 2013 reached up to 154 ha, or on average of each month the area of oil palm plantation which has the potential to be used as raw material ranged between 4.5 ha - 12.83 ha each month. Based on that, the calculation of oil palm wood potential can be calculated using three scenarios, namely optimistic (220 m3 per hectare), moderate (200 m3 per hectare), and pessimistic (164 m3 per hectare).

B. Socio-economy, Cultural, and Environmental Dimensions

➢ *Population Diversity*

The oil palm farmer community in the research setting has a high diversity since they come from different regions and mostly from outside Riau Province.

The oil palm farmer villagers in this research setting were dominated by farmers originating from Central Java as much as 53.00 %, followed by farmers from East Java as much as 12.00 % and farmers from North Sumatera as much as 11.00 %, while Riau or local people was only 2.00 %. This is understandable since generally the oil palm farmers obtained the oil palm plantation land through PIR pattern transmigration program during the New Order era. During the research, the 2 ha of oil palm land and ± 0.4 ha of oil palm trees in the yardland became owned by the farmers. It socially developed the transmigration program that they followed has given invaluable role and positive impacts on the life of the farmers.

➢ *Age Sructure of Palm oil Farmer's Household*

From the survey results, it is known that oil palm farmer households in three districts were categorized into productive age since 70 % of them were 20-60 years old, only 30% categorized into unproductive age.

➢ *Population's education of Palm Tree Farmers*

Referring to the nine-year compulsory education which has been set by the government, then 70% of oil palm farmer households in the survey location were categorized as low, which was maximum of Junior High School graduates, even there was one householder who did not complete his elementary school, 28 % completed secondary education, only 2 % completed Diploma three- equal education (D3).

➢ *The Involvement of Householder in the Village-level Organization*

Generally, the farmers' households participated in the farmer group organization in their region. In the cooperation, there was 73 % of households who participated as members and committee of cooperation and other social organization such as traditional arts organization; Quran recital, social and death and other were relatively low which was only 15% who took part.

➢ *The Involvement of Households in Training / Counseling*

In relation with the participation of oil palm farmer households in the activity of training and counseling on the fields which are considered able to improve the quality of human resources (SDM), it is known that all farmers' households have participated in the training/counseling related to agriculture including plantation. However, there

ISSN No:-2456-2165

are still farmers' households who never participated in the training/counseling in the field of management science, productivity, creative economy, and such.

➢ *Economy Dimension*

The characteristics of the rural economy are related to the process of resource allocation owned by the farmers in the production process. in allocating the resources, the production process is also related to the provision of production infrastructure, the source of capital, the participation and organization of workforce, permanency, product marketing as well as possibly further processing of agricultural products.

➢ *Level of Income and outcome of Sample Farmers*

The number of farmer's family member on average is four people. As much as 66.00% of oil palm farmers received income under IDR 4,700,000 per month, 28.00 % with the range of income between IDR 4,700,000 to IDR 9,400,000, and farmers who obtained income more than IDR 9,400,000 per month were as much as 6.00 %. The income of oil palm farmers can be categorized as adequate in covering the family needs. The different of income was caused by the difference in oil palm land area that the family-owned, namely with the range of 2 ha up to 15 ha.

➢ *Environmental Dimension*

From the environmental dimension, generally, oil palm farmers experienced challenges in managing oil palm waste, which was in the forms of palm leaf fronds and weed grasses inside and around oil palm plantations. 55.00 % of farmers piled the oil palm leaves on underneath the oil palm tree or piling inside the tree, 45 % burned the weed from the oil palm plantation clearance, including oil palm fronds. In terms of oil palm trunks, even though replanting was never conducted, but oil palm tree waste exists due to the damage from pest attack and died, it was done by leaving it in the oil palm plantation.

C. Perception

➢ *Society's Response*

Perception of oil palm farmers community in the research setting overall was categorized as good. This is shown by the total score of respondents' responses on five items of perception instruments, as much as 12720 tu with an average score of 3.44 (Table IV)

No	Description	Response					Number of Resp	Score
		SS	S	RR	TS	STS		
1	**Respondents' response on the idea of oil palm trunk waste processing into particleboard**							
	a. the assessment on the idea of oil palm trunk waste processing into particleboard	**42**	**25**	**21**	**12**	**-**	**100**	**397**
	b. the willingness of respondents in participating in realizing the oil palm trunks into particleboard	**14**	**9**	**33**	**24**	**20**	**100**	**273**
	c. The willingness of respondents to participate in training and learning of oil palm trunk waste processing for valuable use	**19**	**32**	**37**	**12**	**-**	**100**	**358**
	d. respondent's agreement on their regions to be used for the production of oil palm trunk waste into particleboard	**33**	**26**	**34**	**7**	**-**	**100**	**385**
	e. respondent's belief that there will be the business of oil palm trunk waste processing production into particleboard	**-**	**4**	**47**	**27**	**22**	**100**	**307**
Total		**108**	**96**	**172**	**82**	**42**	**500**	**1720**
Average Score								**3.44**

Table 4:- RECAPITULATION OF SOCIETY'S PERCEPTION ON THE IDEA OF OIL PALM TRUNK WASTE PROCESSING INTO PARTICLEBOARD

Note: Total Score = 1720, Average score = 3.44

➢ *Suggestions for Business Management*

From the respondents' answers, they showed that no one of the people was willing to implement the ides of managing the oil palm trunk processing into particle wood commercially independently, both using self-funding or through coaching. Only 8% of the people were willing to implement the idea of commercial business through group business with joint funding, 47 % wanted to implement the group business through coaching 45 % was to be implemented by entrepreneurs or governmental party.

ISSN No:-2456-2165

No	Respondents' Response	Frequency			Total
		Sungai Galuh (Tapung)	Perhe-ntian Raja	Gunung Sahilan	
1	Self-management with self-funding	-	-	-	-
2	Self-management with coaching	-	-	-	-
3	Managed in a group with joint funding	5	3	-	8
4	Managed in a group with supervision	24	20	3	47
5	others	11	7	27	45
		40	**30**	**30**	**100**

Table 5:- RECAPITULATION OF THE COMMUNITY'S SUGGESTION ON THE IDEA OF MANAGING OIL PALM TREES INTO PARTICLEBOARDS

Source: Researcher's survey results

➢ *Challenges in Business Management*

From the respondents' answer, the challenges in the business management by involving farming community in almost all aspects respectively including in the form of investment, technical skills, business management, product marketing and others such as bureaucracy and business communication. Meanwhile, in terms of material did not become a principle problem.

No	Respondents' Response	Frequency					Total and %
		SS	S	RR	TS	STS	
1	Venture capital	76	24	-	-	-	100
	Percentage (%)	76 %	24 %				100 %
2	Technical skills	56	44	2	-	-	100
	Percentage (%)	56 %	44 %	2 %	-	-	100 %
3	Business Management	43	36	11	10	-	100
	Percentage (%)	42 %	36 %	11 %	10 %	-	100 %
4	Product Marketing	68	21	8	3	-	100
	Percentage (%)	68 %	21 %	8 %	-	-	100 %
5	Oil palm trunk material	-	-	36	42	22	100
	Percentage (%)	-	-	36 %	42 %	22%	100 %
6	Others	13	23	72	2	-	100
	Percentage (%)	13 %	23 %	72 %	2 %	-	100 %
Total		**256**	**148**	**129**	**57**	**22**	**600**
Percentage (%)		**42.67 %**	**24.67 %**	**21.5 %**	**9.50 %**	**3.67%**	**100 %**

Table 6:- RECAPITULATION OF SOCIETY'S CHALLENGES ON THE DEVELOPMENT OF OIL PALM TRUNK WASTE PROCESSING INTO PARTICLEBOARD

Source: Researcher's survey results

D. Processing of Oil Palm Trunk into Particleboard

In order to generate particleboard from oil palm trunk waste, several treatments were conducted.

➢ *Initial Treatment on Oil Palm Trunk; Oil Palm Trunk Observation; Visual Observation*

Before visual observation was conducted, initially oil palm trunks were cut down and cut into pieces.

There were two oil palm trunks observed. The first sample (≤ 17 years old oil palm tree) in a relatively wet condition so that it is so that it is easily overgrown with a blackish fungus. The second sample (≥ 20 years old oil palm tree) was drier so that it was not easily overgrown by fungus.

As other monocot plant trunks, oil palm trunk consists of strong vascular bundle and such as ground parenchyma. It appears a strong vascular bundle influenced by the age of the trunk. The first sample of 10-17 years old has denser vascular bundle compared to the second sample of more than 20 years old.

➢ *Water Content Determination*

As explained in several kinds of literature, oil palm trunks absorb water easily. The observation results in the laboratory showed that the water content in the oil palm trunk sample reached up to 75%

ISSN No:-2456-2165

No	Sample	Container Mass (gr)	Container Mass + Initial Sample	Container Mass + Final Sample	Water Content (%)
1	Oil Palm Trunk 1	2,5084	7,5214	3,7133	75,9645
2	Oil Palm Trunk 2	2,4953	7,5049	3,6859	76,2336
3	Oil Palm Trunk 3	2,5048	7,9940	3,8373	75,7251
4	Oil Palm Trunk 4	2,5090	7,4983	3,7977	74,1707
5	Oil Palm Trunk 5	2,5123	7,6855	3,7277	76,5058
Average					**75,7199**

Table 7:- THE TESTING RESULTS OF WATER CONTENT OF OIL PALM TRUNKS
Source: Researcher's survey results

E. Initial Treatment on Oil Palm Trunk

➢ *Size Modification*

In this activity, initially, the oil palm trunks would be used to make oriented strand board. However, the soft part of ground parenchyma was worried will decrease the performance of the generated products. Therefore, it was determined to take vascular bundle fiber as the panel board material.

➢ *Preservation*

In this activity, the preservation of oil palm only performed through drying. The preservation of using chemical material can be conducted with common material for wood. Then, oil palm trunks were dried until the water content reaching 9 – 11 %.

F. The Production Experiment of Wood-alternative Product

➢ *Determination of Adhesive Type*

For composite particleboard production, there are several types of adhesives that can be used as a mixing agent for palm oil fibers that have been dried beforehand, either through the heat of the sun or by using a heating machine oven. In this activity, the type of adhesive used is common for particleboard or plywood, as well as glass-fiber composite, which was phenol formaldehyde, acrylic, and unsaturated polyester.

➢ *Performance Test of Wood-alternative Product*

The quality of wood-alternative product generated was expected to fulfill the standard applied in Indonesia which was Standard Nasional Indonesia (SNI). For particleboard, the SNI applied is SNI – 03-2105-2006. The tested parameter was as follow:

➢ *Density Testing*

According to SNI – 03-2105-2006, the density of the particleboard was between the range of 0.4 – 09 g/cm3. The measurement results of all samples in this activity stated that the density of generated particleboards had fulfilled the requirement of SNI standard (Table VII).

Type of Adhesive	Density (g/cm^3)
Phenol Formaldehyde	0.702
Acrylic	0.572
Unsaturated Polyester	0.892
Melamine Formaldehyde	0.557

Table 8:- DENSITY TESTING RESULTS OF OIL PALM TRUNK FIBER PARTICLEBOARD DENSITY
Source: Laboratory Test Results of BPPT 2014

➢ *Water Content Testing*

The convention in SNI – 03-2105-2006 states that the water content of the particleboard is prohibited to exceed 14%. The testing results stated that particleboard with phenol formaldehyde adhesive did not fulfill the requirement since it has the water content as much as 18% (Table IX)

Type of Adhesive	Water Content (%)
Phenol Formaldehyde	18.06
Acrylic	7.97
Unsaturated Polyester	3.84
Melamine Formaldehyde	14.03

Table 9:- TEST RESULTS OF WATER CONTENT IN OIL PALM TRUNK FIBER PARTICLEBOARD
Source: Laboratory Test Results of BPPT 2014

➢ *Thickness Swell Testing after Soaking*

Type of Adhesive	Thickness Swell Testing after Soaking (%)
Phenol Formaldehyde	5.70
Acrylic	22.09
Unsaturated Polyester	5.71
Melamine Formaldehyde	7.76

Table 10:- TEST RESULTS OF THICKNESS SWELL AFTER SOAKING
Source: Laboratory Test Results of BPPT 2014

The testing results showed that all particleboard samples were measured (thickness around 6 mm) and included in the category of regular structural particleboard which has fulfilled the requirement of SNI. However, acrylic adhesive generated particleboard with the highest water absorption nearing the threshold (Table 1.10). Therefore, the

particleboard with acrylic adhesive is recommended to be used indoors.

➢ *Ball Indentation Hardness Testing according to ISO 2039-1*

Hardness testing is not required in SNI. However, this test is general testing used in determining the quality of the material. The testing results showed that unsaturated polyester adhesive generated the hardness beyond other adhesives (Table XI).

Types of Adhesive	Ball Indentation Hardness (N/mm^2)
Phenol formaldehyde	17
Acrylic	10
Unsaturated polyester	53
Melamine Formaldehyde	17.2

Table 11:- THE TEST RESULTS OF BALL INDENTATION HARDNESS OF OIL PALM FIBER PARTICLEBOARD
Source: Laboratory Test Results of BPPT 2014

➢ *Impact Charpy Test*

Impact Charpy Test was performed based on ASTM D4812. From the test results, it can be stated that Phenol formaldehyde has a high impact Charpy, while unsaturated polyester adhesive has a low impact Charpy.

Types of Adhesive	Impact Charpy (kj/m^2)
Phenol formaldehyde	8.097
Acrylic	6.355
Unsaturated polyester	4.77

Table 12:- THE TEST RESULTS OF BALL INDENTATION HARDNESS OF OIL PALM FIBER PARTICLEBOARD
Source: Laboratory Test Results of BPPT 2014

➢ *Impact Charpy Test on Particleboard based on SNI*

Impact Charpy Test was performed based on ASTM D4812. From the test results, it is concluded that Polyester Adhesive is Unsaturated (UPE). The standard requires the bending diameter due to the impact is 20 mm. The testing results showed that the testing sample did not experience a change with a 100-gram ball being dropped.

➢ *Pull Strength Test*

Pull strength test was conducted according to ASTM D638. The pull strength of the particleboard using unsaturated polyester adhesive generated the best score (Table XIII).

Types of Adhesive	Pull Strength (N/mm^2)
Phenol formaldehyde	2.403
Acrylic	1.501
Unsaturated polyester	3.438

Table 13:- THE TEST RESULTS OF BALL INDENTATION HARDNESS OF OIL PALM FIBER PARTICLEBOARD
Source: Laboratory Test Results of BPPT 2014

➢ *Straight Surface Pull Strength Testing*

This testing was only performed to the particleboard test object with UPE adhesive. The minimum threshold of pull strength required by SNI 03-2105-2006 is 3.1 kgf/cm2. This testing experience a failure due to the adhesive which was glued the test object and iron plate fall off on the strength score of 3.03 kgf/cm2, while the test object was not damaged at all. Therefore, it can be stated that the straight surface pull strength for the test sample was higher than 3.03 kgf/cm2.

➢ *Flexural Strength Testing*

The flexural strength of particleboard was measured using ASTM D-790 method. The test results showed that the flexural strength of particleboard using phenol formaldehyde adhesive has the highest score, slightly higher than unsaturated polyester (Table XIV). Therefore, these two adhesives generated particleboard with the ability to hold a much better load such as when applied as a table.

Types of Adhesive	Flexural Strength (N/mm^2)
Phenol formaldehyde	14.573
Acrylic	6.292
Unsaturated polyester	13.498

Table 14:- FLEXURAL STRENGTH OF OIL PALM FIBER PARTICLEBOARD
Source: Laboratory Test Results of BPPT 2014

➢ *Testing of Dry Flexural Strength and Modulus Elasticity based on SNI 03-2105-2006*

In this testing, only object tests from unsaturated-polyester-adhesive particleboard were used. The testing object has a thickness of 10-15 mm. The testing showed that dry flexural strength of this testing object as much as 139.32 kgf/cm2, higher than the requirement of the quality standard which is 133kgf/cm2. However, the flexural modulus was 11.057kgf/cm2 did not fulfill the standard which was 25,500 kgf/cm2.

➢ *Testing of Wet Flexural Strength Based on SNI 03-2105-2006*

In this testing, only the testing object from unsaturated-polyester adhesive (UPE) particleboard was used. The testing object has a thickness of 10-15 mm. The testing showed that dry flexural strength of this testing object was 83.77 kgf/cm2, higher than the quality standard requirement which was 66kgf/cm2.

➢ *Bolt Resilience Testing*

This testing was only performed on the test object from particleboard with UPE adhesive. The test results showed that particleboards have bolt resilience as much as 55.93 kgf/cm2, higher than the standard which is 51 kgf/cm2.

➢ *Acid Resistance Testing*

No	Types of Sample	Acid Resistance Test Results
1.	Phenol Formaldehyde composite/oil palm fiber	There is no change, crack, cracks, blisters, discoloration, and color fading
2.	Acrylic composite/oil palm fiber	There is softening and a slight of discoloration
3.	Unsaturated Polyester composite/ oil palm fiber	There is no change, crack, cracks, blisters, discoloration, and color fading

Table 15:- ACID RESISTANCE OF OIL PALM TRUNK FIBER PARTICLEBOARD
Source: Laboratory Test Results of BPPT 2014

The test results showed than phenol formaldehyde, and unsaturated polyester adhesives generated acid-resistant particleboard. Meanwhile, for acrylic adhesive sample type was not resistant to acid so that there was a softening, and a slight of color fading.

➢ *Base Resistance Testing*

The test results of base resistance showed that the three types of adhesive used in this activity generated base-resistant particleboards.

No	Types of Sample	Base Resistance Testing Results
1.	Composite Phenol Formaldehyde / Palm Oil Fiber	There is no change in the form of delamination, blistering, rupture, and softening
2.	Acrylic Composite/ Palm Oil Fiber	There is no change in the form of delamination, blistering, rupture, and softening
3.	Unsaturated Polyester composite/ Palm Oil Fiber	There is no change in the form of delamination, blistering, rupture, and softening

Table 16:- BASE RESISTANCE OF OIL PALM FIBER PARTICLEBOARD
Source: Laboratory Test Results of BPPT 2014

From the characteristics of particleboard testing as wood-alternative product illustrated above, it can clearly be concluded in Table XVII

No	Characteristics	PF	Acrylic	MF	UPE	Score SNI
1	Density (g/cm^2)	0.70	0.57	0.56	0.89	0.40-0.90
2	Water Content (%)	18.06	7.97	14.03	3.84	< 14
3	Thickness swell after soaking (%)	5.70	22.09	7.76	5.71	Max 12
4	Dry flexural Strength (kgf/cm^2) ASTM	148.6	64.16	45.34	137.64	
	Dry flexural Strength (kgf/cm^2) SNI				149.12	133.00
	Minimum Flexural Modulus (kgf/cm^2) SNI				11057	25500
5	Wet Flexural Strength (kgf/cm^2)				83.77	66
6	Pull Strength (N/mm^2) ASTM	2.403	1.501	2.51594	3.438	
	Straight Surface Pull Strength (kgf/cm^2) SNI				3.03	3,1
7	Bolt Resilience (kgf/cm^2)				55.93	51
8	Base Resistance	Good	Not Good	Good	Good	Good
9	Base Resistance	Good	Good	Good	Good	Good
10	Impact Charpy (kj/m^2) ASTM	8.10	6.36	0.16	4.77	
	Impact Charpy (Visual observation) (kj/m^2) SNI				Good	Good
11	Ball Indentation Hardness(N/mm^2) ASTM	17	10	17.20	53	

Table 17:- SUMMARY OF PARTICLEBOARD TESTING CHARACTERISTICS
Source: the laboratory test results of polymer technology center BPPT Serpong, Jakarta 2014

In general, particleboard using unsaturated polyester adhesive has a better characteristic compared to the other two samples, mainly in terms of the hardness. However, the impact Charpy of particleboards with unsaturated polyester adhesive is lower than the two other samples.

The particleboard with acrylic adhesive has the characteristics typically lower compared to the other two types, mainly in terms of water absorption. Acrylic-adhesive board cannot stand acid condition.

If compared to the standard of SNI-03-2105-2006, particleboard with UPE adhesive fulfilled almost all the requirements. However, there are some criteria which were not fulfilled such as flexural modulus type 13. Straight surface pull strength was not tested since the adhesive which glued the test object to the iron plate is friendlier than the tested particleboard. Therefore, it can be concluded that the particleboard with phenol formaldehyde adhesive can be used to hold heavy loads and can be used outdoors.

Meanwhile, particleboard with acrylic adhesive can be used indoors and hold lighter loads.

VI. DISCUSSION

A. Discussion on the Results of Socio-Economy Study

➢ *Material Potentials*

With the assumption of material potential is the same each year with the potential in 2013, then the potential of oil palm trunk material in Riau Province with the optimistic scenario, there is material as much as 8,041,220 m3 available each year, with the moderate scenario as much as 7,310,200 m3 and using pessimistic scenario as much as 5,994,364 m3. Furthermore, the material potential in Kampar regency with the optimistic scenario, there will be materials as much as 33,880 m3 available per year, with the moderate scenario as much as 30,880 m3 and with the pessimistic scenario as much as 25,256 m3.

B. Socio-economy, cultural, and environmental dimensions

➢ *Socio-cultural dimension*

The oil palm farmer community in the research setting has a high diversity since they come from different regions and mostly from outside Riau Province. The oil palm farmer villagers in this research setting were dominated by farmers originating from Central Java as much as 53.00 %, followed by farmers from East Java as much as 12.00 % and farmers from North Sumatera as much as 11.00 %, while Riau or local people was only 2.00 %. This is understandable since generally the oil palm farmers obtained the oil palm plantation land through PIR pattern transmigration program during the New Order era. During the research, the 2 ha of oil palm land and ± 0.4 ha of oil palm trees in the yardland became owned by the farmers. It socially developed the transmigration program that they followed has given invaluable role and positive impacts on the life of the farmers.

➢ *Economy Dimension*

The characteristics of the rural economy are related to the process of resource allocation owned by the farmers in the production process. In allocating the resources, the production process is also related to the provision of production infrastructure, the source of capital, the participation and organization of workforce, permanency, product marketing as well as possibly further processing of agricultural products.

According to Raharjo (1999), the agricultural system for villagers is their way of living. In the traditional rural people, typically agricultural farming family and the will manage the production process together. Most farming society in the rural area is categorized as peasants. However, according to Wolf (1983), the humblest peasants do not produce to live biologically, but they also need a surplus agricultural result to finance their socio-cultural needs or commonly known as social costs.

➢ *Environmental Dimension*

Negative impacts from oil palm tree waste has been experienced mainly by the oil palm farmers in Sungai Galuh, Tapung District, where the oil palm trunk woods produced by PTP V Sungai Galuh were felt to have increased the population of beetle pests that attacked the young shoots of the palm leaves and subsequently damaged/ killed oil palm plants. Although spraying of pests has been carried out, both by farmers and PTP V Sungai Galuh, the results have not yet been felt significantly.

The description above, of course, is a positive opportunity if a business that has economic value or can create added value by conducting oil palm trunk waste management into composite particleboards.

C. Perception

➢ *Farmers Community Response*

The response of oil palm farming community in the research setting overall is categorized as good. This is shown with the total score of respondents' response on five-item perception instrument as much as 12720 tu with the average score of 3.44 (Table 5.13) Descriptively supporting oil palm farmers to support the idea of oil palm farmers in processing the waste into total particleboard, this is indicated by the total score of the answer 42 respondents (42.00%) stated strongly agree and 25 respondents (25.00%) agreed, the total score of respondents' responses was 397 or an average score of 3.97. Although farmers support the idea of processing palm oil waste, farmers can be declared hesitant to participate in participating directly in the processing of oil palm trunks into particleboards. This is shown by the respondents' total score of 273 or an average of 2.73. Reasons for farmers' doubts, because the knowledge and skills of farmers are limited and the problem of funds and the market for the output of composite panelboards that will be produced. The oil palm farmers have the willingness to take part in training and learning to process palm tree trunks to be of value use, shown with a total score of 358 or an average of 3.58. Furthermore, the oil palm farmers support or agree if the area is made and the production of palm oil waste processing into particleboard (total scales = 385), but farmers have confidence as doubtful will be realized the production of palm oil waste processing into particleboards (score = 307). This doubt is backed up with the knowledge and skill, market demand on the produced particleboard including investment funding matter, as well as past failure experience which offers investment ideas.

➢ *Suggestions for Business Management*

From the answers of the respondents, they showed that none of the residents were willing to carry out the idea of managing palm oil processing into commercial particleboards individually, either by using their own funds or through coaching. Only 8% of the population is willing to implement the idea of a commercial business through a group effort with mutual funds, 47% want to be implemented with a group business through coaching and 45 % is implemented by entrepreneurs or governmental parties.

➢ *Challenges in Business Management*

From the answers of the respondents that the challenges in managing the business by involving farming community in almost all aspects respectively in terms of capital, technical skill, business management, product marketing and others such as bureaucracy and business communication. Meanwhile, in terms of materials, it does not become a principle problem.

From the explanation of socio-economy, cultural, and environmental dimensions above, it can be stated that:

i. In principle, oil palm farmers provide a positive response to an idea of processing oil palm trunk waste into commercial particleboards or the like. This is particularly true of those businesses which are considered capable of overcoming the problem of palm oil waste in real terms, which so far has never occurred to the farming community.
ii. Although farming community gives a positive response, they have not been willing to participate directly in managing the commercial business by their own power or in a group. The expectation of the farmers is that the business should be taken over directly by the survey either by the private sector or government Barriers to farmers' communities, especially in matters of capital, technical skills, business management, marketing results and others such as bureaucracy and business communication. This is motivated by the quality of human resources both in terms of formal education, non-formal education, poor and limited knowledge.

➢ *Treatment of oil palm trunk into particleboard*

The characteristics of three types of particleboard produced in this activity are namely (i) particleboard with oil palm trunk fibers with formal dehydrated phenol adhesives, (ii) particleboard with oil palm fibers with acrylate adhesives, and (iii) particleboard with oil palm trunk fibers with non-polyester adhesive types saturated.

i. Particleboard with oil palm trunk fiber and phenol formaldehyde adhesive type.

From its characteristics, it can be said that it can be used to hold heavy loads and can be used outdoors.

ii. Particleboard with oil palm fiber and acrylate adhesive type.

From its characteristics, it can be stated that the particleboard with acrylic adhesive can be used indoors and hold lighter loads.

iii. Particleboard with oil palm fiber and unsaturated polyester adhesive.

In general, particleboards using unsaturated polyester adhesive has better characteristics compared to the other two samples, mainly in terms of ball indentation hardness which reached up to 53 N/mm2 and the water content was 3.84 %. Besides that, this particleboard has acid resistance and alkali resistance, because in acidic conditions the particleboard does not change, cracks, blisters, discoloration and color fading. Likewise, in alkaline conditions, there is no change in the form of delamination, blasting, rupture, and softening. However, there are still weaknesses in terms of the strength of the o'clock board. The unsaturated polyester adhesive particles are lower than the other two samples, which is equal to 4.77 kJ/m2.

VII. CONCLUSION

➢ *Conclusion*

i. Oil palm farmers in Kampar Regency gave positive responses to the idea of managing oil palm trunk waste into particleboard or such commercially. This is primarily because the business can manage oil palm trunk waste problems significantly which has never been thought of by the farming community.
ii. The farmer community is not yet willing to be directly involved in managing the commercial business of the production of the composite particleboards from oil palm trees, with their own strength or in groups. The expectation of the farmers is that the business should be taken over directly by the survey either by the private sector or government Barriers to farmers' communities, especially in matters of capital, technical skills, business management, marketing results and others such as bureaucracy and business communication. This is motivated by the quality of human resources both in terms of formal education, non-formal education, poor and limited knowledge.
iii. The characteristics of the three types of particleboards generated in this study can be concluded that generally particleboards using unsaturated polyester adhesives have better characteristics than the other two samples, especially in terms of hardness. However, the impact Charpy of the board is not lower than the other two samples.
iv. Particleboards with acrylic adhesive have characteristics generally lower compared to the other two types, especially in terms of water absorption. Acrylic adhesive boards also cannot stand the acidic atmosphere. Thus, it can be concluded that particleboard with phenolic formaldehyde adhesive can be used to withstand heavy loads and can be used outdoors. While particleboard with acrylic adhesive can be used indoors and withstand lighter loads.

➢ *Recommendations*

i. Direct involvement of commercial business management by corporate both from private institutions or government is immensely expected. Challenges for farmers, especially in matters of capital, technical skills, business management, marketing results and others such as bureaucracy and business communication. This is motivated by the quality of human resources both in terms of formal, non-formal education, poor knowledge, and limited experience.
ii. It is suggested that the business of processing palm oil waste into particleboard using all three sample characteristics, namely with unsaturated polyester adhesives, acrylate adhesives, and phenol formaldehyde adhesives. This is because particleboards using unsaturated polyester adhesives have better

characteristics than using acrylic adhesive and formaldehyde, especially in the case of violence. While particleboards with acrylic adhesives which have characteristics that are generally lower than the other two types, especially in terms of water absorption and cannot stand acidic atmosphere, can be used indoors, and withstand lighter loads. Meanwhile, the particleboards with phenol formaldehyde can be used to hold heavy loads and can be used outdoors.

iii. Before the decision of the pilot project implementation, the development of wood industry from palm trunks with particleboard output, it is better to do further studies to support investment decisions, at least 2 (two) studies must be carried out once in full, namely (i) studies relating economic and financial feasibility, and (ii) the study of composite board product development strategies from oil palm trunk waste and generating Master Plan. This study is equipped with a thorough experiment using over 25 years old oil palm trunk which qualified the standard of SNI-03-2105-2006.

iv. To motivate the society (including oil palm farmers) to participate in supporting the pilot project above, social activities and technical training on oil palm management into simple particleboard can be conducted.

REFERENCES

[1]. Almasdi Syahza, (1998), Peluang Pengembangan Agribisnis di Propinsi Riau, P2TP2 Universitas Riau, Pekanbaru
[2]. Bustanul arifin, 2001. Spektrum Kebijakan Pertanian Indonesia, Erlangga, Jakarta.
[3]. Eriyanto., 1999, Ilmu Sistem : Meningkatkan Mutu dan Efektivitas Manajemen Jilid satu. Bogor IPB Press
[4]. Gibson, E. D, Ruth I Anderson dan Luna Lynn Straub. 1995. Organisasi, Perilaku, Struktur dan Proses. Erlangga. Jakarta.
[5]. Hernanto, F. 1984. Petani Kecil, Potensi dan Tantangan Pembangunan. Ganesa. Bandung.
[6]. Iqbal Hasan. 2004. Analisis Data Penelitian dengan Statistik. Bumi Aksara. Jakarta.
[7]. ¬¬¬¬¬¬¬¬¬¬_____, (1998), Evaluasi dan Strategi Pengembangan Perkebunan Kelapa Sawit di Provinsi Riau. Lembaga Penelitian UNRI Pekanbaru
[8]. Reijntjes Coen, Bertus Haverkort, Waters Bayer, 1999, Pertanian Masa Depan, Kanisius, Yogyakarta
[9]. Regmi, Punya and Weber, Karl, (2000) International Journal of Social Economics Problem to Agricultural Sustainability in Developing Countries and Potential Solution: Divrsity Asian Institute of Technology. Bangkok. MCB University Press
[10]. Soekartawi. 1988. Prinsip Dasar Komunikasi Pertanian. UI Press. Jakarta.
[11]. Soetrisno, Lukman. 1998. Pertanian pada Abad ke-21. Direktorat Jendral