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Finding Policies of Disguised Unemployment Arrangement: Through Various Technological Innovation of Agriculture and Income Diversification for Tidal Rice Farmer

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Abstract: The ecological constraint of tidal lands necessitates agricultural innovation in the related area. But, agricultural technological innovation create disguised unemployment. So that, both of technological innovation and income diversification, combined will offer a solution to cope with the issue of disguised unemployment. This study is aimed to analyzing strategies used to cope with disguised unemployment in the tidal agricultural sector through a combination of technological innovation and income diversification. The study was carried out in the tidal lands in Province of South Sumatra, Indonesia in 2017. This study used a quantitative method with a survey technique. Simple random sampling was conducted to determine each subject population. The analysis used tabulative, mathematical, and simulation method. Technological innovation in agriculture gave to the rising number of disguised unemployment in tidal agriculture sector. Because technological innovation is a must in tidal land, so that to cope with the issues of disguised unemployment, technological innovation in the agricultural sector should be accompanied with the income diversification. However, we should be noted that the combination of agricultural technology innovation policy and income diversification affects to decreasing on household productivity. The results are, by and large, useful for policy makers in designing in arranging disguised unemployment policies.

Keywords: *disguised unemployment, diversification, technology, tidal*

1. Introduction

It has been firmly believed for many decades that only innovative countries will achieve high performance in economic development. The same is true with the tidal agriculture in which the agricultural technology innovation is a prerequisite [1],[9],[19]. However, the application of technological innovation gives rise to issues concerning employment as it decreases the need for labor and creates disguised unemployment in rural areas [2],[3],[23]. The use of technological innovation engenders longer span of unemployment, which contributes to the lower income farmers derive from the agricultural sector [7],[17]. This issue is even more compounded by the majority of agricultural reinvestment made to develop industries with capital-intensive technology [18].

But some studies show that technological innovation has both negative and positive effect on the people in an area. The use of technology can enhance productivity and income simultaneously [6],[17]. In contrast, success in developing indigenous technology is relatively uncertain and will require a period of time. Secondly, most of technology develops in Indonesia have not been able to prove their full commitment to develop economically competitive and technically reliable technology. This leads to the lower demand of human labor and rising unemployment particularly in

the agricultural sector due to the application of technological innovation [1], [3].

Technological innovation hence contributes to the uneven distribution of the farmer labor potential in the agricultural sector. Such situations as these take place in developed countries and particularly in small farms where jobs are found to be lacking (disguised unemployment) yet it is not unemployment in the pure sense. The amount of time left over after agricultural activities are done is used for non-agricultural activities. This is what is called Income Diversification. This is in line with argument made by [2],[3] that income diversification pertains to the economic rationality of farmer households based on social rationality that occurs. Research conducted by [8], [9] on Income Diversification was carried out in a more detailed. By relating the incidence of Income Diversification to disguised unemployment, disguised unemployment should be controllable by income diversification. Income diversification, as a form of social reorientation will serve as a way to maximize use of the remainder of the work time. This income diversification surely does not have an economic effect on the income. The productive economic activities that households engage constitute the application of opportunities that present themselves for income diversification.

Diversification of livelihoods in rural areas is defined as the process of households' constructing diverse activities and social support capabilities for survival and the enhanced standard of living. The inclination of rural households to engage many jobs is frequently discussed. Yet, little is the attempt made to systematically link such behaviour to disguised unemployment mitigation policy is. The investigation into the formulation of policies to cope with the technological innovation-caused disguised unemployment is necessary to assess the role of off-farm economic activities in making best use of the leisure time and increasing income to enhance the societal welfare and the quality of life in a sustainable way. This research is importance in refining policies in terms of unemployment in order to yield optimum benefits for the sustainable economic development of farmer households in the tidal area. Moreover, this

research is crucial and worth consideration as the input for the government, society, and relevant institutions in the future in addition to attention paid to the management of the farmer's household labor from socio-economic aspects. Based on the background elaborated above, this research is aimed to finding strategies to deal with disguised unemployment through a combination of technological innovation and income diversification.

2. Material and Methods

The research was conducted from May to December 2017. Quantitative approach was used with survey technique. The sampling method selected was proportionate Stratified Random Sampling Method based on 4 agricultural technological innovations and 1 control population as seen in Table 1

Table 1: The Process of Sample Determining

No	Location	Population characteristics	Population (Household)	Sample (Household)
1.	Telang Sari Village, District of Tanjung Lago, Regency of Banyuasin	<ul style="list-style-type: none"> • (1) Technological innovation in the form of Rice-Corn Cropping Index (IP 200), (2) Other on farms and off-farm economic activities • (1) Technological innovation in the form of Farming mechanization (<i>Combine Harvester</i>), and (2) Other on farms and off-farm economic activities 	200	36 (18.00 %)
			356	60 (18.86 %)
2.	Sako Village, District of Rambutan, Regency of Banyuasin	<ul style="list-style-type: none"> • 1) Technological innovation in the form of UPSUS Pajale for Paddy and (2) Other on farms and off-farm economic activities • (1) Technological innovation in the form of certified rice seed production and (2) Other on farms and off-farm economic activities 	260	40 (15.38 %)
			65	39 (60.00 %)
3.	Sungai Baung Village, District of Rawas Ulu, Regency of Musi Rawas	Not applying special technological innovation, but applying other on farms and off-farm economic activities (Control Variables)	202	36 (17.82 %)
TOTAL			1083	211 (19.48 %)

The analysis was conducted using tabulative, diagrammatic and simulative method on the the potential variables, allocation of working time, costs, revenues, and household income. Moreover, this study organized solutions to disguised unemployment in rural areas. Diverse technologies and the opportunities afforded to carry out income diversification serve as alternatives to deal with the issues of disguised unemployment. To strengthen the research result, the researcher conducted a Focus Discussion Group (FGD) to identify as much information as possible in terms of the opportunities to cope with disguised unemployment in the tidal area.

3. Results and Discussion

3.1. Investigating into the Disguised Unemployment Cases in the Tidal Area from the

Technological Innovation and Income Diversification Aspects

Disguised unemployment is an unsolve problem which both the national government in general and the regional government in particulars are confronted with and struggling to cope with. Various researchs have been taken to address the problems yet to no avail. Disguised unemployment itself arises from discrepancy between labor demand and labor supply. This problem is worth attention because the disguised unemployment potentially gives rise to various forms of vulnerability to crimes, social, political and poverty upheavals in the future.

[2] argued that the attempts to cope with disguised unemployment in Indonesia have focused on improving the economic structure transformation from

the agricultural sector to industry at a macro level without taking into account of the micro-analysis aspect. Macro analysis is certainly beneficial. Improvements at the macro level, however, will not bring about the decreasing of disguised unemployment in a much. Microanalysis is deemed effective to solve the issues of disguised unemployment because analysis is grounded on the behaviour of social and economic rationality (socio-economic rationality).

Figure 1 displays the effect various agricultural technology innovations on the household disguised unemployment in tidal area. Each kind of technological innovation has a distinct impact. Technological innovation in the form of certified rice seed production increases the allocation of working time and decreases disguised unemployment that is inversely proportional to application of other technologies. Others basically decrease the work time allocation and increase

disguised unemployment in the tidal area. In comparison to other factors, technological innovation in the form of UPSUS Pajale for Paddy considerably contributes to the highest decreasing of time work allocation. This is due to full application of technology of the UPSUS Pajale program by the government (application of integrated crop farming coupled with the mechanization simultaneously).

So, it can be inferred that the general use of technology in tidal land affects the working time allocation and thus boosts the disguised unemployment. The government hence should be discreet in selecting the observable type of agricultural technology particularly to be used in tidal land. The technology used for the agricultural sector should be the labor intensive one instead of capital intensive technology.

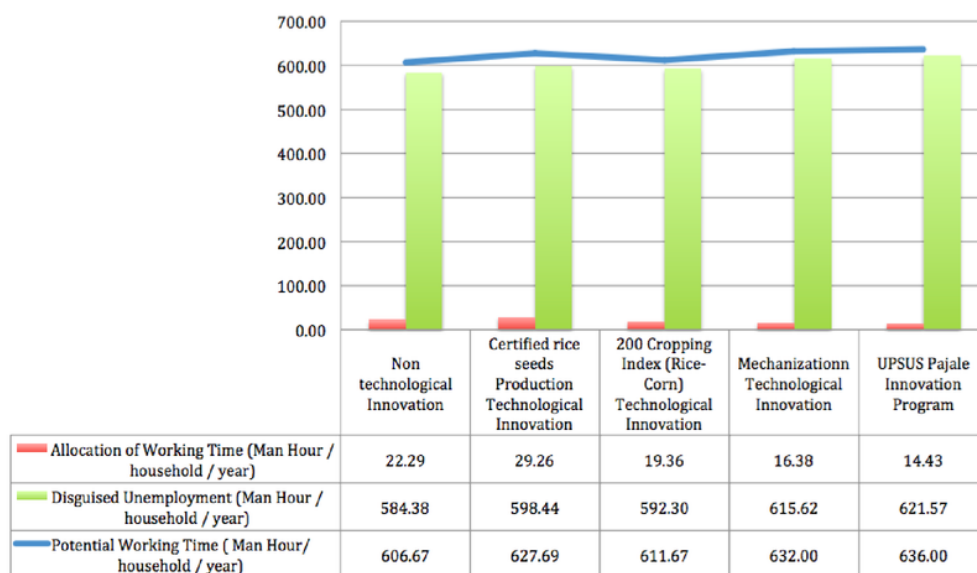


Fig 1: Detailed comparisons between potential working time, allocation of working time, and disguised unemployment for households applying and not applying various technological innovation in tidal area.

However, one thing of interest is that the less amount of working time allocated by farmers' households affects the possible increase of disguised unemployment for households which applying technology. To compensate for the less work time allocated for rice farming, households carry out work activities outside of rice farming and outside agriculture. According to [11], [17], the factors affecting off-farm labor engagement comprise total allocation of work time and labor in the family. The less work time allocated for farming activities done by farmer households the greater is the amount of time devoted to off-farm activities that the off-farm working time is negatively linked to the working time allocated for rice farming. But this is opposed to the finding of

[3] which indicated a positive relationship between the farming and the work time allocated there to. Such a case as this relates to the low allocation of time for farming that both (on farm and off farm activities) potentially increase with the use of technological innovation.

Farmer household members usually engage in a rice farming activity together. In terms of the amount of time allocated for farming activities the quantity of productive assets the household members have such as the area of the land or other productive capitals is a determinant. The more the assets they have, the greater amount of time they spend working on activities that demand huge labor such as cultivating land, planting, clearing and harvesting. When they are not occupied,

many members of the household set their time aside for productive activities both in the agricultural sector and other sectors to earn extra income for the family. This is in line with [21],[22].

The results of this study show that it was not only due to the push factors such as smaller fraction of time allocated for farming sector but also the interaction of the push-pull factors of the off-farm activities. The shift occurs in terms of the working time from on farm to off-farm activities. Some of the push factors comprise: (a) shift in the mental attitude of the labor

toward modernization as the enhanced level of education and social status make the farming activities less appealing and (b) the fixed amount of wages from farming labor tend to be dwindling. Whereas some of pull factors enticing workers away from the farming and rural sectors toward the non-farming sector encompass (a) off-farm job opportunities are increasing, (b) working in non-farming sector is relatively more comfortable, (c) wages rate are more certain and greater, (e) open communication / accessible transportation in rural areas offer support.

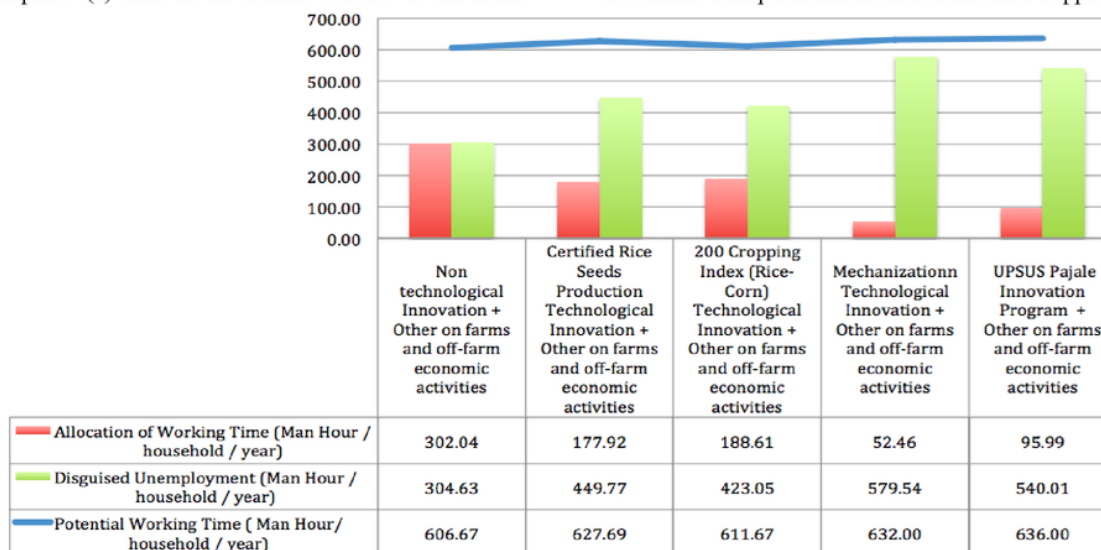


Fig 2: Detailed comparisons between potential, work time allocation, and disguised unemployment for households applying and not applying various technological innovation and income diversification in tidal area.

The implementation of income diversification elevates the amount of work time allocated by farmer household. In terms of the portion, the work time allocated to income diversifications (1) 92.62% for non-technology application, and (2) 81.76% for technology application. While the working time allocated for rice farming is only (2) 7.38% for non-technology applications, and (2) 18.24% for technology application. Income diversification constitutes a crucial and rational decision made by farmer households even though not all farmer households show willingness to put it into practice. Having limited resources, vulnerable households or those without alternative income will be compelled to choose between rice monoculture and diversified practice. This concurs with the statement made by [11] that if farming activities provides low income to satisfy their needs, non-farming income generating sources are needed. Thus, the income diversifications are response to the vulnerability of the household economy and a strategy for survival.

Figure 2 explained comparisons between potential, work time allocation, and disguised

unemployment for households applying and not applying technology followed by income diversification in tidal area. Graphically, the application of technology and income diversification implemented by farmers' households result in the falling rate of disguised unemployment in the tidal area is obvious.

Figure 3 explained detailly a comparison of disguised unemployment cases between households applying and non-applying farming technologies coupled with income diversification. It is cases, when the farmer household resorts to the mere use of farming technology innovation, the high rate of disguised unemployment remains occasioned by the less amount of working time allocated due to the utilization of technology. Whereas, if the use of farming technology is coupled with income diversification, so it lead to the reduced disguised unemployment. The results of this study are relevant to the fact that the non-farming activities help reduce unemployment, create supplementary income, and provide a safety net and alleviate poverty among households. The study recommended that improved road access, access to credit and education should be to

elevate participation in non-farm activities [12]. In line with the research findings of [22], the dwindling labor absorption of farming sector due to mechanization, deteriorating climatic conditions and altered land distributions leads to questioning the conventional wisdom of agriculture as the sole driver for the growth of rural economy. Engagement in other non-farm

activities is seen as a survival strategy in this case, especially for the poor. For well-off households in rural areas, constructing a diversified portfolio of income generating activities is a deliberate investment made in exchange for higher returns through increasing urbanization, market liberalization and development of facilitating policies.

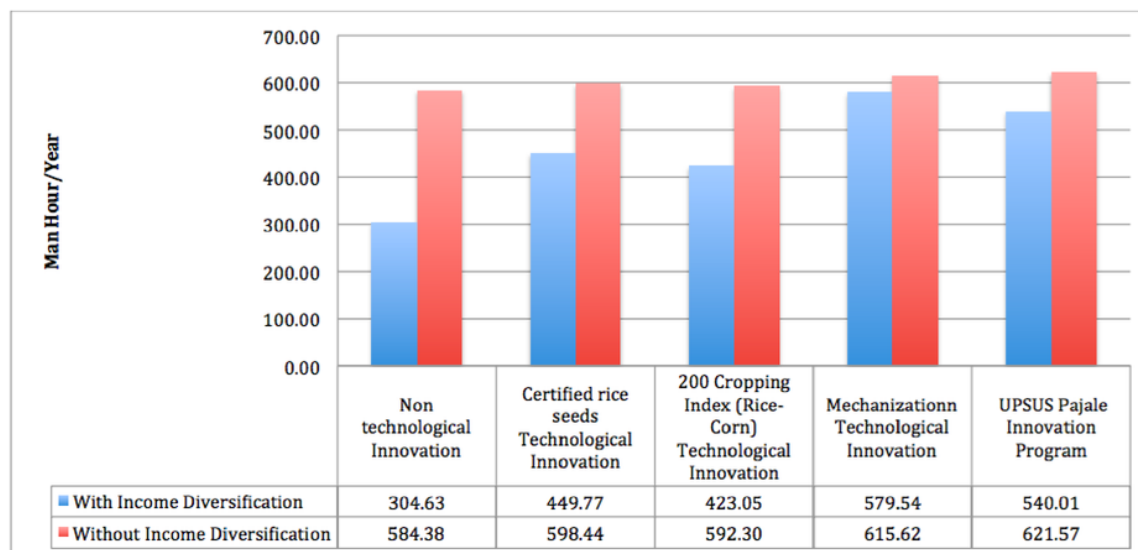


Fig 3: Comparisons between the disguised unemployment for households applying and households not applying various technological innovation coupled with income diversification in tidal land.

3.2. Finding Policies For Disguised Unemployment

Ecological issues of tidal areas that are very dependent on climatic conditions cause technological innovation as a necessity [1]; [5]; [6]. It, however, certainly affects the allocation of working time for the agricultural sector and disguised unemployment. Therefore, the application of technology innovation should go together with income diversification. [2]; [5] argued that farmers have economic rationality due to the lower income they earn from rice farming which furthers the development of social rationality through diversified work structures and laborers in farmer households. Diversification positively affects disguised unemployment and increases income. This study analyses a combination of technological innovation and income diversification as an alternative that is badly needed in tidal land.

Tables 2 through Table 5 quantitatively indicate how the use of technology and income diversification impacts the disguised unemployment, allocation of working time the farmer household's income and productivity. The analysis results in some interesting findings. The use of agricultural technology without income diversification has led to disguised

unemployment increase in the agricultural sector. However, the results of analysis conducted in Tables 2 through Table 3 show that the concurrent adoption of technology and income diversification lead to the reduced rate of disguised unemployment in the agricultural sector by 16.02% and increased amount of work time allocation by 477.50%. Moreover, in terms of income impact analyzed the utilization of technology helps increase income made by the farmer's household by an average of 362%. However, income diversification together with the use of technology contributes to the increase of household income by 552%.

The use of technology serves (1) to negatively increase disguised unemployment rate of 3.87%, and reduce the work time allocated by 10.91%, and (2) has a positive effect on increasing income and household productivity by 362% and 388%. Additionally, the concurrent use of technology and income diversification in the agricultural sector will lower the rate of disguised unemployment rate by 1.83% and increase the amount of work time allocated by 54.63%, income by 488%, and productivity by 243%. Moreover, the use of technology coupled with income diversification both in agriculture and non-agriculture

sector serves to reduce the rate of disguised unemployment by 16.02%, increase the amount of work time allocated by 477.59%, income by 22%, and productivity by 17%.

The results of this study indicate that the issue of disguised unemployment in rural areas can be coped with by adopting policies on the combined use of agricultural technology and farming and off-farm income diversification. Hence, nearly all households observed have diversified farming income and off-farm income. The positive impact of technological advance adopted in agriculture and income diversification increase the allocation of working time, reduce disguised unemployment, and generate income and livelihood for rice farmers' households in sub optimal land. Factors which have positive and significant effects on farmers' use of technology and diversification comprise on-farm income, off-farm income, and age. Therefore, the use of technology and income diversification proves to be one of the positive scenarios for sustainable livelihoods of farmers in sub-optimal land [3]).

According to [7], household income diversification strategy starts off with the process of constructing a variety of businesses and carrying out social cooperation in attempt to survive and improve their standard of living. Based on this research result, income generating sources in accordance with encompass as follows: 1) primary produces of farming, livestock, forestry, fisheries or fish caught including farming labor wages, crops selling and farming produce consumption; 2) Non-farming activities in terms of off-farm income-generating activities such as mining, processed products, public services, development, trading, transportation, government employees; 3) wages earned from working for employers; 4) self-employment earnings; 5) off-farm income generating activities outside the domicile; 6) Non-farming income outside domicile. Low income society usually puts into practice income diversification that it is deemed a survival strategy. This corresponds with the research conducted by [21].

Access to public assets such as roads as well as private assets such as education and credit constitutes

an important factor in income diversification and important reason for income diversification. By gaining increased access to these assets self-reliant businesses as well as wages derived from off-farm businesses will increase. Conversely, damaged road and distance to get to education centers and financial markets affect the possibility of doing income diversification. This is consistent with [14], [19] analyses farm diversification in Norway using qualitative and quantitative variables. Qualitative variables driving diversification comprise location, access to capital loans, and farming organizations, whereas the quantitative variables encompass land area, experience (age), health and insurance expenditure. Considering the results of the Focused Group Discussion, the data analysis result, and literature review, there are several options serving to reduce disguised unemployment in the tidal areas. When farmer households which applying technological innovation focus on rice farming, the rate of disguised unemployment will increase followed by a rise in farming productivity as shown by the results of this study. This result is in line with the finding of the research conducted by [16]; [23]; [7] that the results obtained give several recommendations on the formulation of policy concerning agriculture.

But we still have to take precautionary step. In other words, technological innovation cannot solve the issues of disguised unemployment. If disguised unemployment is only coped with by technological innovation without income diversification, the development of labor intensive agricultural technology is required to uphold. However, we need to be cautious with policies of developing intensive labor technology since several researches unveil that from the stance of productivity, capital intensive technology is more efficient than labor intensive one. Capital-intensive technology development indicates policy-induced factors, such as delicensing, flow of foreign direct investment and imported advanced technology which have positive effect on TFP growth, but labor-intensive industries have failed to capitalize on the benefits [4].

Table 2: The Impact of farming technology innovation and income diversification on the disguised unemployment in the tidal area in 2017

Criteria	Without technology Amount (ManHour/year)	With agricultural technology			With the use of technology and farming income diversification			With the use of technology and farming and non-farming income diversification		
		Amount (ManHour/ year)	Change		Amount (ManHour/ year)	Change		Amount (ManHour/ year)	Change	
			Total change	%		Total change	%		Total change	%
Certified rice seeds Technological Innovation	584.38	598.44	14.06	2.41	551.32	-33.06	-5.66	428.75	-155.63	-26.63
200 Cropping Index (Rice-Corn) Technological Innovation	584.38	592.30	7.93	1.36	585.81	1.44	0.25	439.08	-145.30	-24.86
Mechanization of Technological Innovation	584.38	615.62	31.24	5.35	569.62	-14.76	-2.52	559.21	-25.17	-4.31
UPSUS Pajale Innovation Program	584.38	621.57	37.19	6.36	587.91	3.54	0.61	536.01	-48.36	-8.28
Average	584.38	606.98	22.60	3.87	573.67	-10.71	-1.83	490.76	-93.61	-16.02

Table 3: The Impact of farming technology innovation and income diversification on the allocation of working time in the tidal area, 2017

Criteria	Without technology Amount (ManHour/year)	With agricultural technology			With the use of technology and farming income diversification			With the use of technology and farming and non-farming income diversification		
		Amount (ManHour/ year)	Change		Amount (ManHour/ year)	Change		Amount (ManHour/ year)	Change	
			Total change	%		Total change	%		Total change	%
Certified rice seeds Technological Innovation	22.29	29.26	6.97	31.26	41.88	19.59	87.89	177.92	155.63	698.21
200 Cropping Index (Rice-Corn) Technological Innovation	22.29	19.36	-2.93	-13.13	42.05	19.76	88.63	188.61	166.32	746.19
Mechanization Technological Innovation	22.29	16.38	-5.91	-26.51	20.29	-2.00	-8.96	52.46	30.17	135.35
UPSUS Pajale Innovation Program	22.29	14.43	-7.86	-35.25	33.65	11.36	50.98	95.99	73.70	330.63
Average	22.29	19.86	-2.43	-10.91	34.47	12.18	54.63	128.74	106.45	477.59

Table 4: The Impact of farming technology innovation and income diversification on the income in tidal area in 2017

Criteria	Without technology Amount (IDR/Capita/ /year)	With agricultural technology			With the use of technology and farming income diversification			With the use of technology and farming and non-farming income diversification		
		Change		Amount (IDR /year)	Change		Amount (IDR /year)	Change		%
		Amount (IDR /year)	Change total		Amount (IDR /year)	Change total		Amount (IDR /year)	Change total	
Certified rice seeds Technological Innovation	5,318,626	40,330,505	35,011,879	658	44,877,059	39,558,433	744	50,155,520	44,836,894	843
200 Cropping Index (Rice-Corn) Technological Innovation	5,318,626	34,087,121	28,768,495	541	43,493,373	38,174,747	718	48,375,317	43,056,691	810
Mechanization Technological Innovation	5,318,626	15,832,036	10,513,410	198	16,565,370	11,246,744	211	18,353,703	13,035,077	245
UPSUS Pajale Innovation Program	5,318,626	8,027,986	2,709,359	51	11,667,234	6,348,608	119	21,787,234	16,468,608	310
Average	5,318,626	24,569,412	19,250,786	362	29,150,759	23,832,133	448	34,667,944	29,349,317	552

Table 5: The Impact of farming technology innovation and income diversification on productivity in the tidal area in 2017

Criteria	Without technology Amount (IDR/Capita/ /year)	With agricultural technology			With the use of technology and farming income diversification			With technology and farming and non- farming economic activities		
		Change		Amount (IDR/Capita/ /year)	Change		Amount (IDR/Capita/ /year)	Change		%
		Amount (IDR/Capita/ /year)	Change total		Amount (IDR/Capita/ /year)	Change total		Amount (IDR/Capita/ /year)	Change total	
Certified rice seeds Technological Innovation	238,614	1,378,519	1,139,905	478	1,071,586	832,972	349	281,903	43,289	18
200 Cropping Index (Rice-Corn) Technological Innovation	238,614	1,760,467	1,521,854	638	1,034,446	795,832	334	256,479	17,865	7
Mechanization Technological Innovation	238,614	966,491	727,877	305	816,363	577,749	242	349,872	111,258	47
UPSUS Pajale Innovation Program	238,614	556,257	317,644	133	346,686	108,073	45	226,981	-11,633	-5
Average	238,614	1,165,434	926,820	388	817,270	578,656	243	278,809	40,195	17

The results of this study indicate that technological innovation coupled with household income diversification cope with disguised unemployment issues. Therefore, provided that income diversification in dealing with disguised unemployment it is expected that various diversified income that support agriculture is created in the future. Farming business development comprises:

- a) Reinforcing agricultural politics through bureaucracy, legislation, business practice (agribusiness association), and farmer organizations;
- b) Speeding up the transformatory process through the development of superior commodity-based agro-industries, and of small and medium enterprises (MSMEs), particularly in the agribusiness and agro-industrial sectors;
- c) Establishing policy for capital aid grant to farmers; and
- d) Conserving environment to ensure the sustainable employment in the agricultural sector.

Conclusion

Utilizing technology has an (1) negative effect on increasing disguised unemployment rate by 3.87%, and diminished allocation of work time by 10.91%, and (2) increasing household income and productivity by 362% and 388 % respectively. Moreover, the concurrent use of technology and income diversification in the agricultural sector bring about reduced disguised unemployment rate by 1.83%, increased amount of work time allocated by 54.63%, increased income by 488%, and productivity by 243%. The use of technology coupled with agricultural and non-agricultural income diversification has a positive effect on decreased rate of disguised unemployment by 16.02%, increased amount of work time allocated by 477.59%, increased income by 522%, and productivity by 17%.

Disguised unemployment can only be coped with a combination of agricultural technology innovation and income diversification. The best scenario selected hinges on the interests of each farmer household. Certainly, increased income and productivity should be the concomitants of the goal of solving disguised unemployment. In resolving to increase the income agricultural technology innovation and income diversification policy remain the best choice. One of interest finding of this study shows that the combination of agricultural technology innovation and income diversification engenders low productivity. The results therefore benefit policy makers in coming up with policy concerning disguised unemployment.

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