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The influence of innovation adoption level of integrated plant management on rice productivity of National Strategic Food Center

Tri Prajawahyudo[1,2], Kliwon Hidayat[3], Yayuk Yuliati[3] and Edi Dwi Cahyono[3]

[1]University of Palangka Raya, Central Kalimantan, Indonesia.
[2]Postgraduate Program, Faculty of Agriculture, University of Brawijaya, Malang, Indonesia.
[3]Faculty of Agriculture, University of Brawijaya, Malang, Indonesia

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ABSTRACT

The innovation adoption of integrated crop management consists of two technological components, namely the basic technology component and the selected technology component. The basic technology component consists of the use of superior varieties, quality and healthy seeds, provision of organic material, fertilizing based on plant needs and soil nutrient status, as well as integrated pest control. Whereas the selected technology component consists of tillage according to season and cropping pattern, crop management, effective and efficient irrigation, weeding, and handling of harvest and post-harvest. The influence of the level of innovation adoption of integrated crop management can affect the productivity of lowland rice. The purpose of this study was to analyze the effect of the level of innovation adoption on the productivity of lowland rice in farmers group of national strategic food center in Kapuas Regency, Central Kalimantan Province. Data processing with simple linear regression analysis. The results showed that the level of innovation adoption had a significant and positive effect on the productivity of lowland rice with a significance level of 5%. This is proven by the value of t-Statistics (7,651) > T-Table (1,960)(*two tailed*) and the value of p (sig.) <0,05. Therefore, the hypothesis which states that the level of innovation adoption had an influence on the productivity of lowland rice (accepted). The coefficient value of 0.870, this indicates that there is a positive influence means the higher the level of innovation adoption of Integrated Crop Management then will cause the higher the effect on the lowland rice productivity. Directly the magnitude of the contribution of the level of innovation adoption on the productivity of lowland rice is equal to 0,277 (27,7%).

Key words: *Innovation adoption, Integrated crop management, Productivity*

Introduction

The development of superior varieties of the green revolution era with uncontrolled chemical input to increase rice production, in fact decreases the quality of land, the environment, and the efficiency of the production system (Zakaria and Nurasa, 2016; Rasminto and Setiawan, 2018; Pellegrini and Fernández, 2018). The profits obtained by farmers from rice farming are relatively unbalanced with the costs and labor invested. Learning from this experience, the Agricultural Research and Development Agency seeks to produce innovations that can increase farmers' production and income without damaging the quality of land and the environment. The innovation was later popularly known as the Integrated Crop Management (ICM) model, in line with the demands of a sustainable green revolution that prioritized the improvement of farmer's income and preservation of natural resources.

The development of the capacity of farmer groups in the location of national strategic food center in the Kapuas Regency is expected to improve the quality of human resources in an effort to support the achievement of targets for the improvement of rice production and productivity. Empowerment of national strategic food center farmer groups is an activity to improve the quality of agricultural human resources (HR) in supporting the achievement of specific targets of production and productivity of 7 (seven) national strategic commodities. The seven commodities namely rice, corn, soybeans, various chilies, shallot, sugar cane and beef. The target of seven national strategic commodities needs to be supported and maintained. Agricultural Human Resource Training and Development Agency (AHRTDA) is an institution responsible for preparing agricultural human resources, either extension workers, officers and farmers to become reliable actors through integrated farmer empowerment movement supported by extension, education and training (BPPSDMP, 2015). The national strategic food center farmer group empowerment activities were carried out at 24.000 Agricultural Extension Working Areas (AEWA) in 34 (thirty four) provinces sourced from Deconcentration Fund of the Extension Center (DFEC), 2016 (Ministry of Agriculture of RI, 2015). The purpose of this study was to analyze the effect of the level of innovation adoption of integrated crop management on the rice productivity of national strategic food center in Kapuas District/Regent, Central Kalimantan.

Research Framework

Adoption of innovation is a mental process (behavior change) in the form of knowledge, attitudes, and skills in individuals since introducing innovation until decide to adopt innovation (Seligman, 2006; Basadur and Gelade, 2006). In the context of the improvement of the lowland rice production and productivity, the Agricultural Research and Development Agency / Badan Penelitian dan Pengembangan Pertanian introduced the innovation approach of integrated crop management (ICM) to lowland rice (Rosadillah *et al.*, 2017; Sembiring, 2018). ICM innovation is expected to increase farmers' incomes and maintain the quality of land and the environment. This approach is a holistic and participatory approach adapted to site-specific conditions so it is not a technological package that must be applied by farmers in all locations (Altieri, 2002; Peeters, 2019; Orlando *et al.*, 2020). Integrated crop management (ICM) is a new innovation to solve various problems in the improvement of productivity (Sembiringand Abdulrachman, 2018; Luther *et al.*, 2018; Sawitri and Nurtilawati, 2019). Intensification technology is site specific, depending on the problem to be solved. ICM technology components are determined together with farmers through technological requirement analysis. ICM as an innovative approach in an effort to increase farm productivity and efficiency. There are two components of the innovation adoption of integrated crop management of lowland rice namely the basic technology component and the selected technology component. Where the two technological components greatly affect the productivity of lowland rice.

The level of innovation adoption is the level or degree of application of ICM technological components (Jerop *et al.*, 2018; Jamil *et al.*, 2018; Silva *et al.*, 2018, Stevenson *et al*. 2019; Peshin *et al.*, 2019). ICM of lowland rice is an innovative and dynamic approach in an effort to increase farmers' production and income through the participatory assembly of technological components with farmers. ICM technological components are divided based on the indicators of basic technology component and selected technology components. The basic technology component is a component that must be applied (highly recommended) in the implementation of lowland rice ICM, while the choice of technology components are several components that can be selected based on location needs (conditions, willingness, and ability of local farmers) (Ministry of Agriculture, 2016).

Materials and Methods

Location and Time of theResearch

This research was conducted in Kapuas District / Regency (Selat and Bataguh Subdistrict), Central Kalimantan Province. It is one of the national strategic food clusters / centers locations in 34 provinces throughout Indonesia, from May to October 2018. Geographically, Kapuas Regency is located between 0º8'48 "up to 3º27'00" SL and 113º '36 "to 114º44 '00" EL. Kapuas Regency has a tropical and humid climate with a minimum temperature ranging be-

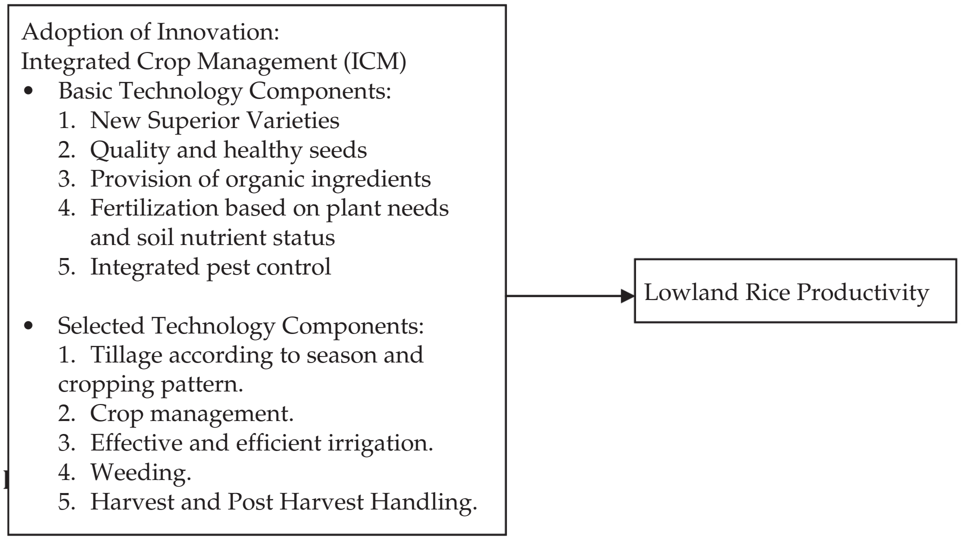

Fig. 1. Frame of Research Concept

tween 21-23ºC and a maximum of 36 ºC. The intensity of solar radiation is always high and water resources are quite high. The rain mostly falls in December, between 886-1,789 mm per year; while the dry month (dry season) occurs in April-August (BPS of Kapuas District, 2019). The research location which carried out is one of the national strategic food centers from 34 provinces throughout Indonesia (Fig. 2).

Determination of Sampling Methods

The measurement of the farmer groups' innovation adoption used a Likert scale, and the unit of analysis was the farmer groups. The determination of sampling method used the proportional stratified random sampling, in which farmer groups in the research area were recorded and listed, then grouped into group strata according to the criteria of the Ministry of Agriculture. Furthermore, each strata was randomly taken as a group sample (respondents) with the distribution of the number of groups representing the strata of the beginner and advanced classes, which amounted to 11% respectively. According to Arikunto, 2013; Schultzberg, and Muthén, 2018; Wauchope *et al*., 2019) if the number of subjects (samples) is large > 100, it can be

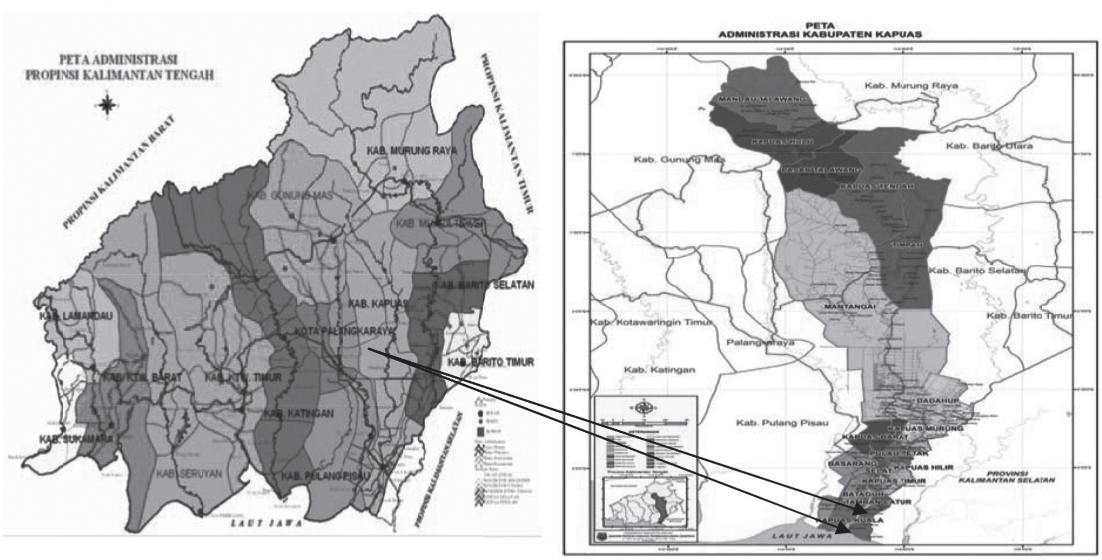

Fig. 2. The Map of Location

taken between 10-15% and 20-25%. Then, the researcher randomly selected 5 members from each of the selected farmer group consisting of 2 administrators and 3 members of the non-management farmer group; so that, the number of respondents from the two classes of the selected farmer groups'ability was 155 respondents (Table 1).

Method of data collection

Data collected in this study are primary data and secondary data. Primary data is data obtained from respondents through interviews using questionnaires arranged on a Likert scale. Questionnaires are a number of written questions that are used to obtain information from respondents in the sense of reports about the person, or thing that he/she knows. Data collection uses the method of triangulation technique from the problem to be collected. Triangulation method is a technique of data collection through interviews, observation, questionnaires, and documentation (Sugiyono, 2017).

Statistical analysis

Based on the research problem, the design of this study using mixed methods that are a blend of quantitative and qualitative. Quantitative data was collected using a questionnaire, while qualitative data was obtained from interviews with farmers. This study uses 2 variables, namely: innovation adoption level and productivity. Data in this study analyzed using linear regression approach.

Test of Hypotesis

Based on the description of the previous theoretical basis and framework, the hypothesis proposed in this study is that there is an influence of innovation adoption level of the integrated crop management on the productivity of lowland rice.

Discussion

The effect of ICM innovation adoption on the productivity of lowland rice

The effect of the variable of the innovation adoption level of ICM on the lowland rice productivity of the national strategic food center in Kapuas Regency in this study uses simple linear regression. Based on the regression analysis can be seen in Table 2.

Based on Table 2, the regression equation is as follows: Y = 0.870X+ e. The results of the analysis obtained the value of $t_{calculate}$amounted to 7.651 with the value of p = 0.000. The value of T-Statistic (7.651) > T-Table (1.960) (*two tailed*) and the value of p (sig.)< 0.05 then can be concluded that the variable of innovation adoption level has a significant effect on the productivity with a significance level of 5% (hypothesisaccepted). Thus, the hypothesis which states that the level of innovation adoption has an effect on the productivity of lowland rice (accepted).

The coefficient value of 0.870, this indicates that there is a positive influence means the higher the level of innovation adoption of Integrated Crop

Table 1. The Number of Respondents Based on Farmer Groups' Ability Class

No	Ability Class	The Number ofFarmer Groups	The Specified Number	Number of groupsample	Number of respondents
1	Beginner	234	11%	26	130
2	Advanced	42	11%	5	25
	Total	276		31	155

Source: Data Processed obtained from The Agriculture Office of the Kapuas Regency (2018)

Table 2. Influence of Innovation Adoption Level on Lowland Rice Productivity

Model	Coefficient	t	P value
Constants	0.524	1.028	0.306
Innovation Adoption Level (X)	0.870	7.651	0.000

Y= Lowland Rice Productivity
R^2 = 0.277, Alpha (α) = 5%
F calculate = 58.545 with the value of p (sig.) = 0.000
Source: Research Data Processed 2018

Management model then will cause the higher the effect on the lowland rice productivity. The contribution of the level of innovation adoption (X) to the productivity of lowland rice (Y) amounted to (R^2) = 0,277. This means that the magnitude of the contribution of the influence of the level of innovation adoption on productivity is 27,7%, and the rest 72,3% is influenced by other variables which not included in the model. Could be suspected that other factors which not included in the model namely individual characteristics factor (demographics) among others age, gender, education (formal or non-formal), experience in the farming, motivation; socioeconomic and cultural factors among others land area, income, land ownership status, social status.

Previous research supporting the results of this study, among others by Kariyasa and Dewi (2012), Bergtold *et al.* (2019); Bagheri *et al.* (2019) which states that farmers adopt an integrated crop management approach based on productivity considerations. Islam *et al*., (2014); Sharma *et al*., (2019), Stuart *et al.* (2018). found that rice productivity was higher in the ICM approach of 185,4%, when compared with conventional cultivation. ICM in rice cultivation saves seeds (60.98%), water (63.66%), reduces costs (70.33%), higher yields, when compared to conventional systems. While Muchtar *et al.* (2015) stated that 91,3% of farmers applied all technologies such as the use of superior seed varieties, planting with the system of jajar legowo, balanced fertilization, intermittent irrigation, control of plant pests (CPP), harvest and post-harvest in integrated crop management.

Wani *et al*., (2017) found the fact that ICM practices of balanced fertilization increase productivity and income around 30% compared to conventional farming systems. Nurbaeti *et al*., (2008) states rice productivity by planting method of jajar legowo can increase 15-20% compared to conventional planting (tegel). The findings of Khatun *et al*. (2018) the ICM approach of BRRI and 56 varieties can maximize rice production in the Barind area, Bangladesh.

While Hiola and Indriana (2018) found the fact that the adoption rate of farmers using the jajar legowo planting system was in the low category, due to the role of instructors who were still relatively low and not yet optimally applied. On the other hand farmers are less proactive, less seeking information. In line with Hiola and Indriana, Malahayatin and Cahyono (2017) also found the fact that farmers are reluctant to apply Jajar Legowo cropping system innovations because considered incompatible with the needs of farmers and relatively complicated in the work, while in terms of production not much different.

Adoption of technology for mechanization of harvesting activities is more efficient in terms of labor, cost and time, and reduces yield losses (Najafi and Torabi, 2018; Vanbeveren *et al*., 2018; Hossen *et al.,* 2018). *Combined harvester* machines can save labor from around 40 people/ha to 7,5 people/ha and can reduce harvest costs up to 30%. Reducing yield losses from 10,2% to 2%, as well as saving harvest time from 4 to 6 hours/ha (Office of Agriculture, 2018). According to Gopalakrishnan, (2017), Purwanti and Susilowati (2018) the negative impact of the mechanization of agricultural machinery shifts the institutional pattern of landcultivation from the sharecropper's pattern towards working on their own land.

The development of cropping index / indeks pertanaman (IP) of lowland rice during the years of 2000 to 2018 continues to experience the IP change , whereas previously the local farmers implement crop pattern with IP 100 or planting 1x in a year using local varieties or seed. But after the introduction of the integrated crop management (ICM) model in 2007, the cropping pattern changed to IP 200 or planting 2x in a year and already using new superior varieties. In terms of productivity has increased very significantly. The average production of lowland rice with an IP 100 only produces between 1-2 tons/ha. While the average production of lowland rice with an IP 200 produces 3-5 tons/ha. (Office of Agriculture, 2018).

Based on the results of the study, the level of innovation of ICM significantly influence on the productivity of lowland rice. This is due to the fact that farmer groups since 2015 have known and implemented ICM innovations. This coupled with the previous experience namely the Integrated Crop Management - Field School (ICM-FS) program that has been introduced to farmers starting in 2007-2014 before the presence of the Integrated Crop Management – Adoption Action (ICM-AA) program which carried out massively, so that farmers or farmer group members are very familiar with ICM technology. This is also what causes ICM adoption rates/ level at the research location to be very high or very much in accordance with the recommendations, so that it has an impact on the productivity of lowland rice.

The increase in productivity is also due to the contribution of academicians from university who come to the location of research in the context of development, research and community facilitation and sharing knowledge innovations and experiences in the case of lowland rice cultivation. One example is the assistance in the farming demonstration, where conducted pilot model with a new superior variety from the breeding result named IR. Dadahup which until now the superior seed innovation was adopted and there was diffusion among farmers or farmer group members.

Conflict of Interest

The authors declared that present study was performed in absence of any conflict of interest.

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Author Contributions

The article is part of the Dissertation of Doctoral and all the authors have contributed: PT data collection, data analysis and writing manuscript, Prof. KHY, Prof. YYL and EDC, Ph.D contributed to review of manuscripts.

Conclusion

The level of innovation adoption of integrated crop management (ICM) has a significant effect on the productivity of lowland rice. It can be seen that from the results of the study indicate that the average respondent admitted an increase in the production or productivity of his/her lowland rice. Directly the magnitude of the contribution of the level of innovation adoption on the productivity of lowland rice is equal to 0.277 (27,7%). The results showed that the level of innovation adoption had a significant and positive effect on the productivity of lowland rice with a significance level of 5%. This is proven by the value of t-Statistics (7.651) > T-Table (1.960) (*two tailed*) and the value of p (sig.) <0.05. Therefore, the hypothesis which states that the level of innovation adoption had an influence on the productivity of lowland rice (accepted). The coefficient value of 0,870, this indicates that there is a positive influence means the higher the level of innovation adoption of Integrated Crop Management then will cause the higher the effect on the lowland rice productivity. The contribution of the level of innovation adoption (X) on the productivity of lowland rice amounted to (R^2) = 0.277. This means that the magnitude of the contribution of the effect of the level of innovation adoption on productivity is 27.7%, and the rest 72.3% is influenced by other factors which not included in the model. Policymakers need to continue the implementation of ICM innovation technology on a broader and gradual scale in accordance with farmers' readiness by still paying attention and balancing the technical elements (complexity of the use of tools and material availability) and economic factors (affordability of the price of tools or materials).

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References

Altieri, M. A. 2002. Agroecology: the science of natural resource management for poor farmers in marginal environments. *Agriculture, Ecosystems & Environment*. 93(1-3): 1-24.

Arikunto, S. 2013. Prosedur Penelitian Suatu Pendekatan Praktik. Jakarta: Penerbit Rineka Cipta, Edisi Revisi VI.

Badan Penyuluhan and Pengembangan Sumber Daya Manusia Pertanian (BPPSDMP). 2015. Pedoman Teknis Pemberdayaan Kelompok Tani di Lokasi Sentra Pangan. Jakarta: Kementerian Pertanian.

Badan Pusat Statistik. 2019. Kabupaten Kapuas Dalam Angka. Kabupaten Kapuas. Kuala Kapuas.

Bagheri, A., Bondori, A. and Damalas, C. A. 2019. Modeling cereal farmers' intended and actual adoption of integrated crop management (ICM) practices. *Journal of Rural Studies*. 70 : 58-65.

Bandura, A. 2010. Selfefficacy. *The Corsini Encyclopedia of Psychology*. 1-3.

Basadur, M. and Gelade, G. A. 2006. The Role of Knowledge Management in the InnovationProcess. *Creativity and Innovation Management*. 15(1) : 45-62.

Dinas Pertanian. 2018. Sistem Informasi Manajemen Penyuluhan Pertanian Kapuas. Kabupaten Kapuas.

Gopalakrishnan, A. 2017. Technologies and Strategies for Doubling Farmers' Income by March, 2022 for the State of Kerala Report Submitted by State Coordination Committee (SCC), Kerala December, 2017.

Hiola, N.A. and Indriana, 2018. Tingkat Adopsi Sistem Tanam Jajar Legowo Pada Tanaman Padi Di Desa Ilomangga Kecamatan Tabongo Kabupaten Gorontalo. *Jurnal Agropolitan*. 5(1) : 53-62.

Hossen, M. A., Hossain, M. M., Haque, M. E. and Bell, R. W. 2018. Transplanting Into Non-Puddled Soils with a Small-Scale Mechanical Transplanter Reduced Fuel, Labour and Irrigation Water Requirements for Rice (*Oryza sativa* L.) Establishment and Increased Yield. *Field Crops Research*. 225 : 141-151.

Islam M., Nath, L.K., Patel, D.P., Das, A., Munda, G.C., Samajdar, T. and Ngachan, S.V. 2014. Productivity and Socio-Economic Impact of System of Rice Intensification and Integrated Crop Management Over Conventional Methods of Rice Establishment in Eastern Himalayas, India. *Journal of Paddy Water Environment*. 12 : 193-2012.

Jamil, M. H., Musa, Y., Tenriawaru, A. N. and Rahayu, N. E. 2018. The Innovative Characteristics and Obstruction of Technology Adoption for Management of Integrated Plants of Corn in Gowa Regency Indonesia. In: *IOP Conference Series: Earth and Environmental Science.* (157), 1.

Jerop, R., Dannenberg, P., George Owuor, G. and Mshenga, P. 2018. Factors Affecting the Adoption of Agricultural Innovations on Underutilized Cereals: The Case of Finger Millet among Smallholder Farmers in Kenya. *African Journal of Agricultural Research*, 13(36) : 1888-1900.

Kariyasa, K. and Dewi, Y.A. 2012. *Analysis of Factors Affecting Adoption of Integrated Crop Managment Farmer Field School (ICM-FFS) in Swampy Areas*. *International Journal of Food and Agricultural Economics*. 1(2): 29-38.

Kementerian Pertanian, R.I. 2015. Pemberdayaan Teknis Kelompok Tani di Lokasi Sentra Pangan Tahun 2016. Jakarta: Pusat Penyuluhan Pertanian Badan Penyuluhan dan Pengembangan SDM Pertanian RI.

Kementerian Pertanian RI. 2016. Pedoman Umum Pengelolaan Tanaman Terpadu (PTT) Padi Sawah. Jakarta: Balai Penelitian dan Pengembangan Pertanian.

Khatun, N, Rahman, M.A. and Devi, P. 2018. Integrated Crop Management (ICM) for Increasing Rice Production in Barind Area. *African Journal of Agricultural Research.* 13(16) : 886-889.

Ladha, J. K., Kumar, V., Alam, M. M., Sharma, S., Gathala, M., Chandna, P. and Balasubramanian, V. 2009. Integrating crop and resource management technologies for enhanced productivity, profitability, and sustainability of the rice-wheat system in South Asia. *Integrated crop and resource management in the rice–wheat system of South Asia*. 69-108.

Luther, G. C., Mariyono, J., Purnagunawan, R. M., Satriatna, B. and Siyaranamual, M. 2018. Impacts of Farmer Field Schools on Productivity of Vegetable Farming in Indonesia. In *Natural Resources Forum.* 42(2) : 71-82.

Malahayatin, D.M. and Cahyono, E.D. 2017. Faktor Kesesuaian Dengan Kebutuhan Petani Dalam Keputusan Adopsi Inovasi Pola Tanam Jajar Legowo (Studi Kasus Petani Padi di Kecamatan Widang, Kabupaten Tuban). *JEPA-Jurnal Ekonomi Pertanian dan Agribisnis*. 1(1): 57-61.

Muchtar, K., Susanto, D. and Purnaningsih, N. 2015. Adopsi Teknologi Petani Pada Sekolah Lapang Pengelolaan Tanaman Terpadu. *Jurnal Penyuluhan*. 11(2) : 176-185

Najafi, B. and Torabi Dastgerduei, S. 2018. Optimization of Machinery Use on Farms with Emphasis on Timeliness Costs.

Orlando, F., Alali, S., Vaglia, V., Pagliarino, E., Bacenetti, J. and Bocchi, S. 2020. Participatory approach for developing knowledge on organic rice farming: Management strategies and productive performance. *Agricultural Systems*. 178 : 102739.

Peeters, A. 2019. Participatory and holistic approaches with grassland farmers and development of policies.

Pellegrini, P. and Fernández, R. J. 2018. Crop Intensification, Land Use, and On-farm Energy-Use Efficiency during the Worldwide Spread of the Green Revolution. *Proceedings of the National Academy of Sciences*. 115(10) : 2335-2340.

Peshin, R., Bano, F. and Kumar, R. 2019. Diffusion and Adoption: Factors Impacting Adoption of Sustainable Agricultural Practices. In *Natural Resource Management: Ecological Perspectives* (pp. 235-253). Springer, Cham.

Purwantini, T.B. and Susilowati, S.H. 2018. Dampak Penggunaan Alat Mesin Panen Terhadap Kelembagaan Usahatani Padi. *Jurnal Analisis Kebijakan Pertanian*. 16(1) : 73-88.

Rasminto, R., Khausar, K. and Setiawan, C. 2018. Tinjauan Spasial Produksi Padi Dalam Upaya Meningkatkan Ketahanan Pangan di Kabupaten Bekasi. *Genta Mulia, Jurnal Ilmiah Pendidikan*. 7(2).

Rosadillah, R., Fatchiya, A. and Susanto, D. 2017. Penerapan Pengelolaan Tanaman Terpadu Padi Sawah di Kecamatan Toili, Kabupaten Banggai, Sulawesi Tengah. *Jurnal Penyuluhan*. 13(2): 143-156.

Sawitri, B. and Nurtilawati, H. 2019. Kapasitas Petani Padi dalam Penerapan Teknologi Pengelolaan Tanaman Terpadu (PTT) di Kecamatan Tamansari Kabupaten Bogor Jawa Barat. *Jurnal Penyuluhan Pembangunan*, 1(1): 26-43.

Schultzberg, M. and Muthén, B. 2018. Number of subjects and time points needed for multilevel time-series analysis: A simulation study of dynamic structural equation modeling. *Structural Equation Modeling: A Multidisciplinary Journal*. 25(4): 495-515.

Seligman, L. 2006. SensemakingThroughoutAdoption and the Innovation-Decision Process. *European Journal of Innovation Management*. 9(1) : 108-120.

Sembiring, H. and Abdulrachman, S. 2018. Potensi penerapan dan pengembangan PTT dalam upaya peningkatan produksi padi.

Sharma, P. C., Datta, A., Yadav, A. K., Choudhary, M., Jat, H. S. and McDonald, A. 2019. Effect of crop management practices on crop growth, productivity and profitability of Rice–Wheat System in Western Indo-Gangetic Plains. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences*. 89(2): 715-727.

Silva, A. G., Canavari, M. and Sidali, K. L. 2018. A Technology Acceptance Model of Common Bean Growers' Intention to Adopt Integrated Production in the Brazilian Central Region. *Die Bodenkultur: Journal of Land Management, Food and Environment*. 68(3) : 131-143.

Stevenson, J., Vanlauwe, B., Macours, K., Johnson, N., Krishnan, L., Place, F. and Vlek, P. 2019. Farmer Adoption of Plot and Farm-Level Natural Resource Management Practices: Between Rhetoric and Reality. *Global Food Security*. 20 : 101-104.

Stuart, A. M., Devkota, K. P., Sato, T., Pame, A. R. P., Balingbing, C., Phung, N. T. M. and Singleton, G. R. 2018. On-farm assessment of different rice crop management practices in the Mekong Delta, Vietnam, using sustainability performance indicators. *Field Crops Research*. 229 : 103-114.

Sugiyono, 2017. Statistika Untuk Penelitian. Bandung: Penerbit CV Alfabeta, Cetakan ke 28.

Vanbeveren, S. P., De Francesco, F., Ceulemans, R. and Spinelli, R. 2018. Productivity of Mechanized Whip Harvesting with the Stemster MkIII in a Short-Rotation Coppice Established on Farmland. *Biomass and Bioenergy*. 108 : 323-329.

Wani, S.P., Anantha, K.H. and Garg, K.K. 2017. *Soil Properties, Crop Yield, and Economics Under Integrated Crop Management (ICM) Practices in Karnataka, Southern India*. *Article in World Development*. 93 : 43-61.

Wauchope, H. S., Amano, T., Sutherland, W. J. and Johnston, A. 2019. When can we trust population trends? A method for quantifying the effects of sampling interval and duration. *Methods in Ecology and Evolution*. 10(12) : 2067-2078.

Zakaria, A. K. and Nurasa, T. 2016. Strategi Penggalangan Petani Untuk Mendukung Program Peningkatan Produksi Padi Berkelanjutan. *Analisis Kebijakan Pertanian*. 11(2) : 75-87.