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Empowerment of Indonesian Farmers in the Industrial Revolution 4.0

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Abstract. **The era of the fourth industrial revolution or called Industry 4.0, has become a reality in Indonesia. Indonesia, as an agricultural country, needs to prepare a strategy to adapt to the digital industry. Industrial revolution 4.0 characterized by applied technology, such as advanced robotics, artificial intelligence, internet of things, virtual and augmented reality, additive manufacturing, and distributed manufacturing that can change production patterns and business models in various industrial sectors. The project of the German government, which first promoted the term industry 4.0, was used to improve the computerization of manufacturing. The role of the social sciences of humanities is needed in the framework of technological development so that technology does not eliminate human values. The results showed the production and productivity of corn in Indonesia and the country of Columbia influenced by land area, tractor machinery, and harvesting machinery. But the partial analysis of agricultural land harm on the productivity of maize, tractor, and harvest machinery has a positive effect. In contrast, in Columbia, the farmland has a positive impact. Tractors and harvest engines negatively affect.**

Keywords: industrial revolution, empowerment, maize, production, productivity

INTRODUCTION

Indonesia is one of the populous countries in South East Asia. This condition affects food needs following the increasing population [1], efforts to increase productivity [2], technology for rice productivity [3], because this technology tends to increase higher automation, speed, and accuracy [4]. The use of agricultural technology in Indonesia is a dilemma because technology reduces or even eliminates the role of farmers. Research shows that there is a negative impact, namely a shift in the pattern of land cultivation institutions, initially using the magic model to work on the land itself using machinery. The effect of labor work reduced peasants and wage reductions in the ***Bawon*** system. Another problem is the unpreparedness of farmers to manage agricultural machinery [5].

Poverty in Indonesia and Ghana is due to the low investment capacity of farmers, dependence on funds, basic needs of farmer households, lack of access to financial institutions, and extension services [6].

The regional government's role is very important because the local government knows more about the local characteristics in the study. Empowerment must be done by the local government when facing ASEAN Trade Liberalization (MEA) to ensure the government's fort program (UPSUS) on food self-sufficiency by improving the system irrigation, production facilities, optimization of land management, development of the Rice System y means of intensification, the Movement for the Implementation of Integrated Plant Management (GP-TPP) as well as, procurement of agricultural machinery and equipment [7].

METHOD

The study uses the example of Indonesia and Columbia, the reason for comparing Indonesia with Columbia, because Columbia, including countries belonging to the developed countries of the OECD, assuming countries belonging to the OECD developed countries, using technology to facilitate all matters.

This research is a quantitative study using time series data from the Food Agriculture Organization (FAO) data from 1980 to 2005. The data included in secondary data categories, including production, productivity, agricultural land use, tractor and harvest machine use from the State of Indonesia. And Columbia, data analysis using linear regression analysis, while the software used is software version 23. The commodity studied is corn, because corn is a valuable food commodity in Indonesia, Columbia

also produces it. The models developed are Indonesian corn production (QINA) and Indonesian Corn productivity (YINA). Columbia corn production (QCOL) and Indonesian Corn productivity (Y COL). Where corn production and productivity influenced by variable harvested land area (LHN) variable X1, the number of tractor engines used (T) variable X2, and the harvesting engine (H) variable X3 used in both countries, the model is as follows:

The Indonesian Production and Productivity Model (INA) is:

$QINA_1 = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \epsilon_1$

$Y\ INA_1 = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \epsilon_1$

The Columbia Production and Productivity Model (COL) is

$Q\ COL_1 = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \epsilon_1$

$Y\ COL_1 = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \epsilon_1$

Before interpreting the results, the BLUE test is first performed, including Heteroscedasticity, Autocorrelation, and Multicollinearity.

RESULT & DISCUSSION

FAO states that Indonesia and Colombia are corn-producing countries. Both countries use agricultural machineries such as tractor and harvester, but do not use milking machines, agro machinery, and soil machines.

Data analysis shows that the use of agricultural land (LHN), Tractor (T), and Harvester (H) has a large contribution to Indonesia. It can be seen from the R2 value of 0.96 or 96 percent, which means agricultural land, Tractor, and Harvester form a model Corn production in Indonesia. Compared to Colombia, which is only 0.567 or 57 percent, shows that land use is a determining factor for corn farming in Indonesia. The development of Indonesian food crop agriculture was corroborated by research, prioritizing land acquisition agriculture, not agricultural machinery [8]. A summary model of the factors affecting corn production in the two countries can see in Table 1.

Table 1. Summary Model of Indonesia and Columbia State Production

Model Summary Indonesia				
Model	R	R Square	Adjusted R Square	Std. The error of the Estimate
1	,980[a]	,960	,954	465919,44140
Model Summary Columbia				
Model	R	R Square	Adjusted R Square	Std. The error of the Estimate
1	,753[a]	,567	,502	2343,26502

Factors for Corn Production in Indonesia (Q INA) and Columbia (Q COL)

Indonesia and Columbia State Corn Production Model, formed by agricultural land (LHN), tractor (T), and harvest (H) In Indonesia, the effect is very significant at 0,000 percent. Signifies the variable agricultural land, tractor engines, and harvest engines that have a considerable impact on a corn production model in Indonesia, as well as in Columbia. The significance value of the variable agricultural land, tractor and harvest machinery on corn production in the country of Columbia is 0,001 use of agricultural machinery in Indonesia is still experiencing problems, in research Indonesian farmers are ready to face the industrial revolution 4.0 if the farmers have high incomes, are young, take part in agricultural counseling, and are male, then in this study, It is recommended to use youth groups and farmer groups as a tool to carry out advice training in farming skills [9], the description in the table can be seen in table 2 below

Table 2 Anova Production of Indonesian and Columbia Countries

Model Indonesia		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	105315116923799,810	3	35105038974599,938	161,714	,000[b]
	Residual	4341618517490,120	20	217080925874,506		
	Total	109656735441289,940	23			
Model Colombia		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	488889583270,485	3	162963194423,495	9,059	,001[b]
	Residual	359777130511,140	20	17988856525,557		
	Total	848666713781,625	23			

Factors of Maize Production in Indonesia and Colombia

The corn productivity model in Indonesia is formed by the variables of agricultural land (LHN), harvesting machinery (H), and tractor machinery (T). It shows from the results of the coefficient R2, amounting to 0.906, or 90.6 percent. Meaning the productivity model is contributed by variable agricultural land (LHN), harvest machinery (H), and tractor machinery (T). Only 9 percent by other variables.that agriculture in Indonesia is highly dependent on agricultural land, the use of tractors and harvesting machinery. This is confirmed by research, a tractor is needed because of the scarcity of sugarcane agricultural labor in the Central Java region, the use of hand tractors are more effect 35.54% compared to manual [10], but in the country of Columbia the contribution of agricultural land (LHN), harvest (H) and tractor (T) was only 56.7 percent. This shows that the use of agricultural land in Colombia using a machine than a tractor and harvesting machine is not so significant, as described in Table 3.

Table. 3 Summary Productivity of Indonesia and Colombia

Model	R	R Square	Adjusted R Square	Std. An error of the Estimate
INA	,952[a]	,906	,892	1611,68814
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
COL	,753[a]	,567	,502	2343,26502

a. Predictors: (Constant), LHN, H, T

Influence of Variable Variable Agricultural Land (LHN), Harvesting Machine (H), and Tractor Engine (T) Partially In the analysis of the importance of agricultural land variables (LHN), the use of tractor engines (T) and harvest machines (H). The results show that in Colombia, the use of tractors harms corn productivity. This shows that there are still other corn farming machines besides the tractors used. So does the use of agricultural land negatively affect corn productivity. Meaning that wider land use will reduce corn productivity. This information is contrary to the theory that land use will increase productivity in Colombia as a country incorporated in the OECD was not optimal in using and corn farming. In Indonesia, the use of tractors is very influential in corn productivity.

Table 4 Coefficient Productivity of Corn Indonesia and Columbia

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
COL	(Constant)	22310,285	9918,305		2,249	,036
	H	2,331	2,920	,203	,799	,434
	T	-,331	,174	-,535	-1,902	,072
	LHN	-,005	,007	-,138	-,713	,484
INA	(Constant)	17074,840	3146,551		5,427	,000
	LHN	-,001	,001	-,046	-,470	,643
	T	,114	,032	,784	3,589	,002
	H	,008	,009	,206	,871	,394

a. Dependent Variable: Y

Empowerment of Farmers in Indonesia in the Industrial Revolution Era 4.0

In the era of the industrial revolution, the use of technology matters in agriculture. For example, in research precision agriculture managing resources such as water, fertilizer, soil, and grains to increase production, quality, reduce waste products to create a friendly environment [11]. In Indonesia, the use of machinery reduces the role of farmers in the agricultural sector, and agricultural laborers have reduced wages.

As one of the developing countries, Colombia has a relatively small population, higher education, and high income to provide agricultural machinery. Indonesian farmers who can afford farming machines hire young men peasants to help them. This shows that the industrial revolution makes women peasants marginalized, whereas women peasants can work better if they get training opportunities. Research on irrigation implementing farmers, the majority of irrigation implementing women mastering water use efficiency techniques. The program, the FEATI Program is managed with attention to gender, the benefits of the program are capable women adopting learning technology to form a Duck Joint Business Group (KUB), empowering women as well as empowering women farmers, researched by applying appropriate and innovative technology, protecting the female workforce, increasing the effectiveness of training, improving coordination patterns, providing facilities, wage rates, fostering household industry skills [12].

Radio is very effective in completing agricultural extension methods and can increase farmers' participation in climate change. Suggestions for further research should explore the use of social learning approaches that encourage groups rather than individual listeners (such as community groups listening to the radio and community-based radio schools)[13]

Empowerment is also expected to be accepted by men and women fairly, the study found that women's participation in the rural labor market, women doing unpaid, seasonal and part-time work, and showed that women were often paid lower than men, for the same job [14]. Yet if women are given technical training, for example, Farmer Field Schools in rural Nepal on Integrated Pest Management is proven to be able to increase women's participation in FFS, its positive impact on family food security [15].

CONCLUSION

Maize production and productivity in Indonesia and Colombia are affected by land area, tractor, and harvest machinery. But the partial analysis of agricultural land affects negatively on the productivity of maize. Tractor and harvest machinery have a positive effect, whereas, in Colombia, agricultural land has a positive effect. Tractors and harvest engines negatively affect.

Government investment in agricultural machinery is very urgent to do, both in terms of quantity and in the form of appropriate technology that is friendly to the ability of farmers, farmers must be willing to group and in groups are used as learning facilities (learning organization), Farmer empowerment must prioritize gender justice for both men and women because men and women farmers are human resources, which are assets if only relying on male peasants will be less than optimal.

REFERENCES

[1] S. Wisnujati Nugrahini Susantinah, Hanani Nuhfil, Setiawan Budi, "RJOAS, 7(67), July 2017," *RJOAS*, vol. 7, no. July, pp. 108–109, 2017.

[2] S. Rusdiana and A. Maesya, "Jurnal Sosial Ekonomi dan Kebijakan Pertanian," *J. Sos. Ekon. dan Kebijak. Pertan.*, vol. 7, no. 2, pp. 176–187, 2018.

[3] putu arimbawa and A. Widanta, "Pengaruh Luas Lahan, Teknologi dan Pelatihan terhadap Pendapatan Petani Padi dengan Produktivitas sebagai Variabel Intervening di Kecamatan Mengwi," *E-Jurnal Ekon. Pembang. Univ. Udayana*, vol. 6, no. 8, pp. 1601–1627, 2017.

[4] A. Lele and S. Innovation, "Industry 4.0," pp. 205–215, 1850.

[5] T. B. Purwantini and S. H. Susilowati, "Dampak Penggunaan Alat Mesin Panen terhadap Kelembagaan Usaha Tani Padi," *Anal. Kebijak. Pertan.*, vol. 16, no. 1, p. 73, 2018.

[6] B. Permadi, "Community Empowerment and Farmer Poverty Reduction in Developing Countries," *J. Public Adm. Stud.*, vol. 4, no. 1, pp. 9–13, 2019.

[7] W. N. . Koesriwulandari, "RJOAS, 10(70), October 2017," vol. 10, no. October, pp. 140–149, 2017.

[8] N. Tinaprilla, N. Kusnadi, B. Sanim, and D. B. Hakim, "ANALISIS EFISIENSI TEKNIS USAHATANI PADI DI JAWA BARAT INDONESIA," *Agribus. J.*, 2013.

[9] Nurmawiya and R. Kurniawan, "Analisis Kesiapan Petani Dalam Menghadapi Era Revolusi Industri 4.0," *Semin. Nas. Pembang. Pertan. III*, vol. 0, no. July, 2019.

[10] D. Purwantoro, T. Dianpratiwi, and S. Markumningsih, "Analisis Penggunaan Alat Mesin Pertanian Berbasis Traktor Tangan pada Kegiatan Perawatan Budidaya Tebu," *agriTECH*, vol. 38, no. 3, p. 313, 2019.

[11] B. Bansod, R. Singh, R. Thakur, and G. Singhal, "A comparison between satellite-based and drone-based remote sensing technology to achieve sustainable development: A review," *J. Agric. Environ. Int. Dev.*, vol. 111, no. 2, pp. 383–407, 2017.

[12] R. Elizabeth, "Pemberdayaan Wanita Mendukung Strategi Gender Mainstreaming dalam Kebijakan Pembangunan Pertanian di Perdesaan," *Forum Penelit. Agro Ekon.*, vol. 25, no. 2, p. 126, 2016.

[13] F. Mwaniki, C. Gichuki, M. Mwangi, P. Mburia, and B. O. Wandago, "Addressing challenges in communicating adaptation practices to smallholder farmers in Kenya through a radio intervention," *J. Agric. Environ. Int. Dev.*, vol. 111, no. 2, pp. 279–322, 2017.

[14] H. Tian *et al.*, "Global patterns and controls of soil organic carbon dynamics as simulated by multiple terrestrial biosphere models: Current status and future directions," *Global Biogeochem. Cycles*, vol. 29, no. 6, pp. 775–792, 2015.

[15] A. Westendorp and L. Visser, "Farmer Field Schools: Unexpected Outcomes of Gendered Empowerment in Wartime Nepal," *J. Asian Dev.*, vol. 1, no. 1, p. 1, 2015.