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The Role of Rural Infrastructure, Labour and Capital Investment on the Rice Production in Malaysia

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Recently, rice production has gained significant attention due to increasing requirements and rural infrastructure, labour, and capital investment have been considered the significant factors for rice production that need researchers' attention. Hence, the present article examines the impact of rural infrastructure, labour and capital investment on rice production in Malaysia. The current study has extracted secondary data related to crop production from the Department of Agriculture, extension census of agriculture state series, yearly report ministry of Malaysia and department of statistics at state levels. In addition, data for rural infrastructure, labour and capital investment has been collected from the Department of Statistics Malaysia (DOSM) and the World Bank. The current study has applied the Augmented Dickey-Fuller Test (ADF) to examine the unit root and autoregressive distributed lag model (ARDL) to test the association among the variables. The findings indicated a positive correlation between rural infrastructure, labour, capital investment and rice output in Malaysia.

Key words: Rural Infrastructure, Labour and Capital investment, Rice Production

1. INTRODUCTION

Rice is an important staple food crop in Malaysia and is consumed by all levels of Malaysians. The crop is highly cherished and consumed daily. The average rice consumption per capita in 2016 was 80 kilograms per person per year. This equates to around 2.7 million Metric tonnes of rice consumed by Malaysians in 2016 at an average monthly cost of RM44 per family. As a large rice consumer, Malaysia also has to increase rice production to meet the country's growing population's rice consumption. On the other hand, domestic output accounted for only 67% of total production, with the remainder of Malaysia relying heavily on rice imports from Thailand, Vietnam, and Pakistan (Omar, Shaharudin, & Tumin, 2019). Despite the substantial increase in rice production in Malaysia, the rate of increase in rice production is less than the population growth rate.

Rice cultivation is an ancient, heavily protected, and subsidised industry in Malaysia. In the new global economy, rice cultivation has become a central issue for food security in Malaysia. Nowadays, the competitiveness of the environment has made the Malaysian government cautious and more aware of the rising population and the demand for rice production. Malaysia has eight main granary paddy areas that can support the ' 'population's rice demand and are regarded as food security for the nation. This was established under National Agricultural Policy (NAP) 1984 – 1991 for strategic intervention in the paddy and rice ' 'sector's development and to secure national food security (Firdaus, Leong Tan, Rahmat, & Senevi Gunaratne, 2020a). There are various policies, strategies, and programmes for rice production in this main granary area to support and strengthen paddy 'farmers' livelihoods because farmers remain in the B40 household category.

Besides, MAFI's primary goal is to modernise and improve the agriculture sector, enhancing SSL levels and boosting industry revenue. Furthermore, Budget 2022 also focuses on the paddy and rice industry to ensure that food security achieves 75 per cent SSL in 2025. For 300,000 farmers, the Director-General of MAFI plans to boost input and output subsidies, such as subsidies for fertilisers and pesticides for hill paddy, as well as a pricing scheme of RM360 per metric tonne for rice mills, which will allow them to raise their production while also increasing their net incomes (Salisu, Gao, & Quan, 2021). Food security is also a significant issue in Malaysia. According to the Department of Statistics Malaysia (DOSM), ' 'Malaysia's rice sufficiency level is 69 per cent in 2019, while in 2020 drop to 63 per cent.

On the other hand, The Agriculture and Food Industries Ministry (MAFI) target a self-sufficient level (SSL) of 75 per cent for the local rice production by 2025 (Harun, Hanafiah, & Aziz, 2021). This was stated in the 12th Malaysian Plan (12MP) that it comprises the transformation and modernisation of the local agri-food industry and boosts SSL levels for other food sources (12th Malaysian Plan). Furthermore, table 1 below shows five-year Malaysia Plan from year 1966 until 2025, and the Plan estimates different targets to achieve SSL because it will forecast according to the previous year SSL and include the economy growth. Previous year Malaysia not achieving 100 percent SSL because of the COVID-19 Pandemic. SSL in 2019 achieved 69% and had a decline in 2020 at 63 per cent. MAFI plan for the next five-year,

Malaysia will achieve 75% SSL of rice with a new programme and initiative to help 'farmers' livelihood and improve rice production.

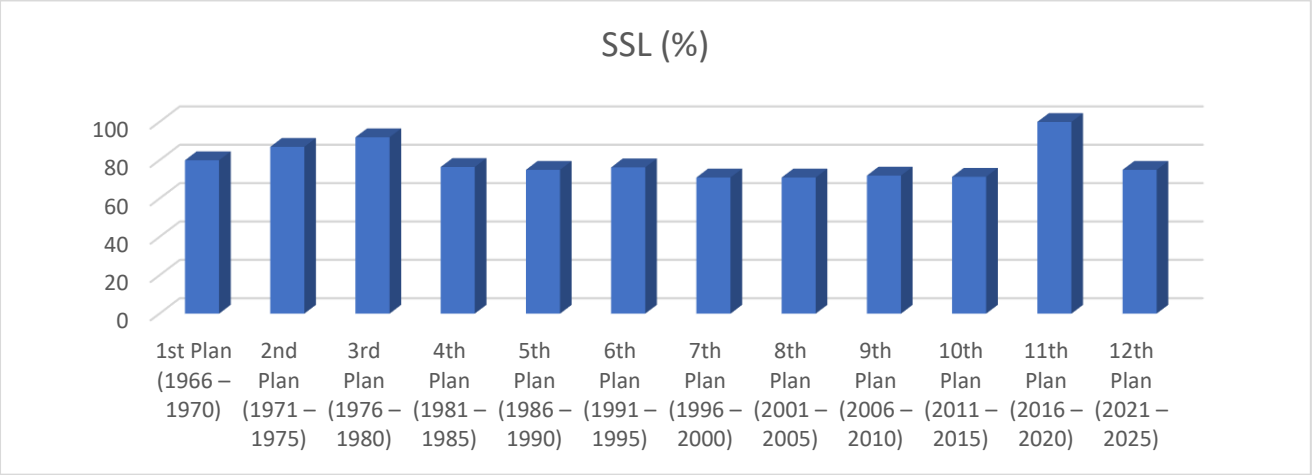

Figure 1: ' 'Malaysia's Rice Self-sufficiency Level (SSL)

Moreover, implementing the National Fourth Industrial Revolution (4IR) will boost all sectors to enhance food security, especially agriculture. Agriculture's development may be reinvigorated if new technology and innovative farming are used. A major focus here is accelerating the transformation of agriculture into a modern, dynamic, and competitive industry backed by increased Research, Development, Commercial and Innovation (R & D, C & I) be better (12th Malaysia Plan). The National Food Security Framework and the National Agro-Food Policy 2021-2030 (NAP 2.0) will be implemented to achieve food self-sufficiency targets and international food safety standards. Additionally, NAP 2.0 explains that rice and paddy are a significant subsector of basic daily foods, with the record SSL increasing from 60.3% in 2010 to 60.3% in 2019. (69.0%).It was not achieving our SSL target yet (Hanafiah et al., 2019). Due to that, this policy applies some strategies, which are using land and water irrigation efficiently, harnessing the potential of a variety of special local rice, restructuring subsidies towards empowering production in a business decision, involving more participation from private sectors along the value chain, and promote, encourage, and train youth to engage in paddy and rice sub-sectors. The paddy and rice sub-sector strategy aims to increase production volume, improve subsistence level, improve the efficiency of using natural resources, and improve paddy farmers' living standards and income levels for the next ten years (Nodin, Mustafa, & Hussain, 2022).

Malaysia is suffering from a lack of food production, especially rice production. According to a study conducted on several factors, issues, challenges, and problems affecting Malaysia's paddy cultivation. Furthermore, the rice industry in Malaysia faces several challenges, including land competition, because urbanisation and the expansion of other industrial projects caused a decline in soil fertility because of the use of numerous chemical fertilisers. Besides, land for agricultural activities is limited, caused by the opening of unsustainable forest areas that will damage the environment, especially water pollution occurs. Most agricultural activities globally use freshwater resources to get higher quality for their crops (Firdaus, Leong Tan, Rahmat, & Senevi Gunaratne, 2020b). Rice farming is plagued by infrastructure challenges, contributing to the crop's poor performance.

The poor rural infrastructure contributes to the weaker performance of rice farmers and increases their level of poverty. Also, the low rice productivity has led to low self-sufficiency in the country (Rusli, Noor, Taib, & Han, 2018). Generally, infrastructure facility in Malaysia is poor, especially in the rural areas of the study area. There is a lack of good storage facilities for the paddy seeds to be distributed to the farmers and thus resulting in low productivity of rice. Poor access to some rural infrastructure facilities hinders full utilisation of potentials in rice farming.

Furthermore, rice production's low and higher production cost efficiency also influences 'farmers' income. This is because technology usage in the rice industry remains low because small-scale producers tend towards traditional farming due to insufficient financial support and education. In addition, an investor lacks interest, an investor lacks interest in increasing financial support and developing the best product due to the low-profit perceptions and high risk for investors. In other words, rice production lacks infrastructure facilities because most farmers depend on the middleman's imported agricultural input (Akhtar & Masud, 2022).

Moreover, youth have a poor perception of the Agro-food sector, which is labour intensive and has a low return compared to work at the organisation. Young farmers also face many challenges, such as land availability and loan

application without collateral to start up. Besides, there is competition for labour costs with foreign workers because that will reduce 'farmers' income. However, the 12th Malaysia Plan emphasises strengthening smart farming to recover agriculture sectors and economic growth. The adoption of smart farming through modern and new technology will transform the agriculture sector become a dynamic and competitive sector. However, implementing smart farming with youth participation because they are still fresh and can get proper education about agriculture sectors can also specialise in machinery and efficient management (Rahim et al., 2021; Tan, Fam, Firdaus, Tan, & Gunaratne, 2021). Furthermore, there is a need for policy changes that allocate funds to support youth involvement in rural development, guidance and support for young farmers seeking to develop their diversification strategies, lifelong learning opportunities, and, finally, the use of creative methods to engage young people in rural development (Akhtar, Masud, & Afroz, 2019).

This research attempts to increase efficiency by identifying the critical factors affecting rice production efficiency in Malaysia at the national and household levels. This research may contribute to a better understanding of the variables affecting rice output in Malaysia. First and foremost, research into the factors that contribute to this issue will enable the development of more effective policies and strategies for increasing sustainable rice production and identifying technical advancement policies that should be implemented to improve Malaysia's rice sector. It is more sustainable to identify these aspects that impact rice productivity. Secondly, this research may suggest increasing SSL rates in Malaysia for food security. As a result, there is potential to boost output from current farmlands if rice production efficiency is improved via modern farming and new infrastructure facilities. Therefore, greater output and productivity are fundamentally contributed to increased production efficiency. Besides, the research becomes significant since it will discover the elements affecting Malaysia's rice-producing system.

2. LITERATURE REVIEW

Most literature examines rice production using labour and capital (conventional Cobb-Douglas Production Model), which is incomplete in examining rice productivity (Bapari & Joy, 2017).

Recent studies on crop productivity incorporate infrastructure in affecting crop productivity, such as Wang, Huang, Wang, and Findlay (2018), Cook (2011) and Manjunath and Kannan (2017). These studies focused on the impact of infrastructures, such as roads, communication, irrigation, electricity, farm size, fertiliser, education, storage, credit, and extensions on agricultural production or productivity, using the Cobb-Douglas production function, translog cost function, and regression analysis and the results found that infrastructure and irrigation are crucial in increasing crop productivity. However, the level of technology adopted and the distribution model are not discussed in crop productivity. The level of technology and distribution of seed, fertiliser, technology, and goods that move from manufacturer to farmers is crucial to improve productivity and therefore needs to be discussed. In addition, Osanyinlusi and Adenegan (2016) viewed productivity as the level of an output concerning the level of resources used in viewed agricultural productivity as a measure of the ratio of agricultural outputs (market value of final output) to agricultural be measured by the total factor productivity (TFP) by comparing the index of inputs to outputs, the total inputs used in the production. Efficiency measures the technical and allocation of inputs in production to pro efficiency in economics when dealing with product performance. The two concepts are used interchange involved in the production; thus, the two are related (Dilipkumar, Burgos, Chuah, & Ismail, 2018). Tanko, Kang, and Islam (2019) viewed infrastructure as dynamic in economic development theory. It refers to the services of tertiary production activities depend. These infrastructures include social and capital/public services such as law and Ord supply, transportation, electricity, irrigation, and drainage systems. Infrastructure facilities are the backbone for development, allowing the collaboration of factors of production to facilitate one another in production. A study by De Soyres, Mulabdic, and Ruta (2020) reports that supporting the development of a nation has a positive impact on productivity and welfare of people, though very expect were the major problem of development to the third world nations. Thus, requires adequate planning especially in rural areas.

Rice is an essential component in the agriculture sector and plays a key role in Malaysia's Gross Domestic Product (GDP). In the new global economy, rice cultivation has become a central issue for food security in Malaysia. Unfortunately, Malaysia's gross domestic product (GDP) in rice productivity has declined continuously since 1975. The last two decades have seen a declining trend toward paddy cultivation in Malaysia. As the agriculture sector lost its importance in the national economy, insufficient rice productivity has received considerable critical attention from the government. Over the past decade, most research in paddy productivity has emphasised the importance of domestic rice production. The existing literature on domestic rice cultivation is extensive and focuses particularly on the factor affecting rice production in Malaysia. A large volume of published studies describes the importance of rice production and consumption. According to Bashir and Yuliana (2019), increasing rice food security is a critical development objective since rice food is the most fundamental human requirement. Similarly, Azwardi, Bashir, Adam, and Marwa (2016), revealed that rice cultivation is critical since it may also help alleviate poverty. This is because there is a lack of good storage facilities for the paddy seeds to be distributed to the farmers, thus resulting in low rice productivity.

Moreover, a significant relationship exists between the

socio-economic factors of paddy farmers and their paddy production. Hussin and Mat (2013) found that several socio-economic and physical characteristics had significant effects on paddy productivity in Malaysia. In addition, household size and level of education are very important and the main factor affecting paddy 'farmers' income. According to Afroz, Muhibbullah, and Rahman (2021), poverty among farmers occurs because of the no-farm income and lower education in agriculture, which positively influenced farmers. Besides that, adopting technology for a fertiliser that could boost rice production was significant and positively impacted. According to Saiz-Rubio and Rovira-Más (2020), greater adoption of digital farming will improve farmers' finances and ting the food need of an expanded population. In addition, young farmers with better education must use this technology to balance the ageing population in rural areas.

Some gaps are identified based on the previous literature concerning the impact of infrastructure on agricultural productivity study. Many infrastructure studies by Cook (2011), Ojo, Ogundeji, Babu, and Alimi (2020) and Azwardi et al. (2016) focused on the effect or impact of irrigation, electricity, farm size, fertiliser education, storage, credit, and extensions on agricultural production or productivity translog cost function, and regression analysis. Besides, Tanaka et al. (2017) suggest further study on yield variations for further development in the yield. Alam, Humphreys, and Sarkar (2017), requirement and crop performance. Martins et al. (2017) recommend a study on changes in soil quality.

Furthermore, there are inconsistencies in the reports of studies on climate change in Nigeria. Besides, Huong et al. (2017) and Zhang et al. (2017) recommend further study on perceived risks of climate change practices and the barrier to adaptation practices. Despite a substantial increase in world rice production, the growth rate is less than the population growth. Thus, this study intends to fill the literature gap by adopting the Neoclassical Douglas stochastic frontier production function model to examine the impacts of technology, infrastructures, labour, and cap Malaysia. Technology improvement and infrastructures are essential to increase rice productivity besides labour and capital. M labour and capital (conventional Cobb-Douglas Production Model) is not complete in examining rice productivity (Nazli, Halim, Abdullah, Hussin, & Samsudin, 2018).

Additionally, this study addresses a gap in previous research on the regression model by examining rice productivity using infrastructure (irrigation, extension), improved seeds (technological advancement), and capital and labour as inputs.

The new model of rice productivity includes technological change, infrastructure, capital, and labour. Using this improved model, policies are recommended to increase rice productivity and meet the self-sufficiency of 70 percent of Malaysia.

The framework indicates the determinants and flow of how rice production is produced until distributed to household levels. Next, the ability of farmers to get higher paddy crops and diversify their income and capital as sources to get higher yields once adopting new machinery and technology (Rahman et al., 2019). Furthermore, these aspects are critical in determining food security outcomes and will significantly impact the selection of evaluation indicators. As a final point, the framework emphasises that food security is not an aim but rather an important component in the larger idea of human well-being for rice as a staple food and to make sure rice will be sufficient for all populations in Malaysia. These aspects of food security and rice production are influenced by the framework's selection of indicators and infrastructure in rice production to analyse and examine rice productivity. According to the World Food Programme in the Comprehensive Food Security & Vulnerability Analysis Guidelines (CFSVA), macroeconomy analysis in food availability, household accessibility, and utilisation plays a role in determining how well they can feed themselves. Additionally, this is an introduction to the right to appropriate rice nutrition and the capacity of farmers to raise their income through the adoption of infrastructures in the production framework. The interplay generally influences the paddy production status among various infrastructures, technology, fertilisers, and seeds.

Furthermore, achieving food security requires addressing all three of these separate dimensions, ensuring that the aggregate availability of physical supplies of food from domestic production, commercial imports, food aid, and national stocks is sufficient. Second, household livelihoods provide adequate access for all household members to those food supplies through home production, market purchases, or transfers from other sources. Third, the utilisation of those food supplies is appropriate to meet all individuals' specific dietary and health needs within a household. Lastly, stabilisation occurs when all pillars above are accomplished, although it will expose with risk exposure and need high resilience. Having food security means that all people, at all times, have physical and economic access to a sufficient supply of safe, nutritious food that meets their dietary requirements and food choices to live an active and healthy lifestyle (Saeed, Harun, & Nasef, 2019).

Moreover, this framework to understand this research how well the domestic production of rice can get a high yield also, the rural farmers will be farming easily with available infrastructure. From either a short- or long-term viewpoint, the food security analysis is a static assessment of food availability and household restrictions to that access, with little consideration of the changing environment. Therefore, risk and vulnerability analysis for rural infrastructure in rice production was needed to take a more dynamic and forward-looking approach to rice availability. Then, it considers the risk that farmers experience in paddy production in their day-to-day decision-making and their

ability to react effectively over time. The result of the self-sufficient level of rice will be known when this study examines all variables.

2.1 Data Collection and Analysis Techniques

To collect the necessary and relevant data for statistical analysis, the number of accessible observations is defined by the central limit theorem, which asserts that as the number of discrete occurrences increases, the function resembles a normal distribution. Over 29 years, researchers examined annual data from 1990 to 2019. Furthermore, secondary data will be collected from the crop production state office, Department of Agricultural, Extension Census of Agriculture State Series, Yearly report Ministry of Malaysia and Department of Statistics. In addition, data for food security will be collected from the Department of Statistics Malaysia (DOSM) and the World Bank. To estimate the analysis, the factors expected to be evaluated rice output as a proxy for labour, paddy production, fertiliser, irrigation, machinery, and capital investment. The estimation data will be based on the annual data sector-wise.

Rice production, labour, capital investment, infrastructure adoption, and food security indicators are all proposed as variables in the empirical model. Besides, the Cobb-Douglas production function will use for this study to measure the productivity of rice production. At the same time, the food security index is defined in its four pillars: food availability, accessibility, utilisation, and stabilisation. This research uses the Cobb-Douglas production function to view that rice production output results from the amount of labour and capital invested. Furthermore, this function will measure the changes or improvements in efficiency, technology, and infrastructure. The model was following;

$$Q_t = \alpha_0 + \beta_1 Inf_t + \beta_2 Lab_t + \beta_3 Cap_t + e_t \quad \textbf{(1)}$$

Where:

Q = Rice productivity

Inf = infrastructure or technology adopted

Lab = amount of labour

Cap = Capital Investment

The adoption of infrastructure was computed as an independent variable to identify the impact of rural infrastructure on rice productivity in the rice-producing centres and investigate the rural infrastructure causing the differences in rice yield among rice farmers in the Northern region. The explanation of the model based on the Cobb-Douglas production function is as follows:

$$Rp_t = \alpha_0 + \beta_1 Fms_t + \beta_2 Irg_t + \beta_3 Els_t + \beta_4 Lab_t + \beta_5 Cap_t + e_t \quad \textbf{(2)}$$

Where:

Rp = rice productivity

Fms = farm size

Irg = irrigation facility

Els = electricity supply

Lab = Amount of paddy farmers

Cap = Capital Investment

The current research has examined the correlation matrix that shows the association among the variables. In addition, the current research has also run the ADF test that exposed the unit root among the variables. The equation of the ADF test is given as under:

$$d(Y_t) = \alpha_0 + \beta t + \gamma Y_{t-1} + d(Y_t(-1)) + \varepsilon_t \quad \textbf{(3)}$$

The current article also runs the ARDL model to assess the short and long-run association's association. The ARDL model can suit the study when some variables are stationary at the level, and some are stationary at first difference. In addition, the ARDL model provides both long and short-run associations. In equation (4), δ_1, δ_2, δ_3, δ_4, & δ_5 shows ""short-run coefficients""""""". While φ_1, φ_2, φ_3, φ_4, φ_5, & ε_1 show the "long-run coefficients" and the error term. The ARDL model is shown below:

$$\Delta Rp_t = \alpha_0 + \sum\delta_1 \Delta Rp_{t-1} + \sum\delta_2 \Delta Fms_{t-1} + \sum\delta_3 \Delta Irg_{t-1} + \sum\delta_4 \Delta Els_{t-1} + \sum\delta_5 \Delta Lab_{t-1} + \sum\delta_6 \Delta Cap_{t-1} + \varphi_1 Rp_{t-1} + \varphi_2 Fms_{t-1} + \varphi_3 Irg_{t-1} + \varphi_4 Els_{t-1} + \varphi_5 Lab_{t-1} + \varphi_6 Cap_{t-1} + \varepsilon_1 \quad \textbf{(4)}$$

3. RESEARCH FINDINGS

The current research findings have shown the correlation matrix that shows the associations among the variables. The results exposed that Fms, Irg, Els, Lab and Cap positively associated with Rp of the study. Table 1 shows the correlation matrix.

Table 1: Matrix of correlations

Variables	Rp	Fms	Irg	Els	Lab	Cap
Rp	1.000					
Fms	0.382	1.000				
Irg	0.534	0.622	1.000			
Els	0.620	-0.091	0.982	1.000		
Lab	0.362	0.872	0.152	0.982	1.000	
Cap	0.525	0.288	0.542	0.272	-0.662	1.000

Additionally, the current research utilised the ADF test, which revealed the unit root relationship between the variables. The findings indicated that the Rp, Fms, Irg, and Lab were all stationary at the same level. Moreover, the data demonstrated that Els and Cap were level stationary. The results of the ADF test are shown in Table 2.

The study also runs the ARDL bound test to explore the co-integration among the variables. The results indicated that calculated f-statistics (5.732) are larger than the critical values at a five and ten per cent level of significance. Table

3 shows the ARDL bound test results.

The current study used the ARDL model to examine the short-run connection between variables. The results suggested that Fms, Irg, Els, Lab, and Cap have a positive and statistically significant relationship with the study's Rp. The relationship between the constructs in the short run is seen in Table 4.

Table 2: Unit Root Test

Augmented Dickey-Fuller Test (ADF)	Level	t-statistics	p-values
Rp	I(0)	-2.652	0.034
Fms	I(0)	-2.655	0.031
Irg	I(0)	-2.821	0.021
Els	I(1)	-6.872	0.000
Lab	I(0)	-2.721	0.025
Cap	I(1)	-5.282	0.000

Table 3: ARDL Bound Test

Model	F-statistics	Lag	Level of Significance	Bound test critical values	
				I(0)	I(1)
Rp/(Fms,Irg,Els,Lab,Cap)	5.732	4	1%	6.251	6.743
			5%	5.162	5.672
			10%	4.123	4.629

Table 4: Short Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Fms)	0.665	0.232	2.866	0.024
D(Irg)	0.873	0.219	3.986	0.009
D(Els)	4.987	1.672	2.983	0.025
D(Lab)	1.342	0.452	2.969	0.026
D(Cap)	2.192	0.512	4.281	0.000
CointEq(-1)*	-1.392	0.281	-4.954	0.000
R-squared	0.542	Mean dependent var		-0.041
Adjusted R-squared	0.539	S.D. dependent var		2.319

The current study has checked the long-run association among variables using the ARDL model. The results indicated that Fms, Irg, Els, Lab and Cap have a positive and significant association with the Rp of the study. Table 5 shows the long-run association among the constructs.

Table 5: Long Term Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Fms	1.342	0.341	3.935	0.002
Irg	3.928	1.147	3.425	0.008
Els	1.282	0.267	4.081	0.000
Lab	3.429	0.681	5.035	0.000
Cap	2.922	0.815	3.585	0.006
C	0.988	0.295	3.349	0.013

4. DISCUSSIONS

The results indicated that rural infrastructure is positively associated with rice production in Malaysia. The developed infrastructure always provides the best ways to enhance the production of a particular product. The developed rural infrastructure related to the rice field enhances rice production. This outcome matched with the Daud, Omotayo, Aremu, and Omotoso (2018) investigated that the developed infrastructure in the rural area can increase the production of a particular crop and enhance the country's economic growth. In addition, these results are also in line with Mgale and Yunxian (2020) also examined that a strong infrastructure always provides the best circumstances for the high level of rice production in the country.

Moreover, the findings also revealed that trained and large in number labour has a positive association with rice production in Malaysia. The trained and large quantity of labour enhances the production of the particular product, and the high quantity of labour related to the rice field enhances rice production. This output is similar to what Laing et al. (2018) investigated that the high quantity of labour in the rural area can increase the production of a particular crop and enhance the country's economic

growth. In addition, these results are also in line with Ojo et al. (2020) also examined that the high quantity of labour always provides the best circumstances for the high level of rice production in the country.

In addition, the results also explore that the high capital investment in rice crop production has a positive linkage with rice production in Malaysia. The high capital investment brings opportunities for the former to apply the best seeds, irrigation systems, medicines, and other necessary facilities for rice production. These facilities provide high chances of an increase in the production of rice products in the country. This finding is consistent with Bashir and Yuliana's (2019) investigation, showing that significant capital investment supplied farmers with all the necessary facilities to increase agricultural yield in the country. Additionally, these findings are consistent with those of Asadi, Alavijeh, and Zilouei (2018), who discovered that large capital investment in any field gives all of the facilities necessary to boost production in the country, namely rice production.

5. IMPLICATIONS AND LIMITATIONS

The study made some theoretical advances by adding to the existing body of knowledge about rural infrastructure and rice production. Additionally, this article contributes to the current literature on labour and rice production in Malaysia. Additionally, the current research investigated the literature on capital investment and rice output by supplementing it with Malaysian data. Additionally, the current analysis is one of the first to attempt to predict rice output using rural infrastructure, labour availability, and capital expenditure. The current research serves as a guide for regulators as they draught laws connected to increasing rice production through rural infrastructure, labour, and capital investment. The current article is also beneficial for future studies that intend to investigate this subject.

The current article has some limitations, like the current study has taken only rural infrastructure, amount of labour and capital investment as the predictors and ignored the other factors and suggested that future studies should add these factors in their analysis. In addition, the present research also ignored the mediating and moderating impact in the framework and suggested that future studies should incorporate these aspects in their studies. Finally, the current study has taken only rice production in Malaysia and ignored other crops and suggested that future studies should add other crops in their studies.

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