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The Role of Socio-economic Conditions, Energy Consumption, and Environmental Conditions on the Livestock Production in Indonesia

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ABSTRACT

Recently, livestock suffered from low production due to environmental issues that need researchers' emphasis. Hence, the current study investigates the impact of socio-economic conditions such as income and education level, energy consumption, carbon dioxide (CO_2) emissions, and economic growth on livestock production in Indonesia. The study has taken secondary data from a secondary source like World Development Indicators (WDI) from 1987 to 2020. The article also used the autoregressive distributed lag (ARDL) model to check the relationships among the variables used in the study. The findings exposed that the socio-economic conditions such as income and education level, energy consumption, and economic growth have a positive while CO_2 has a negative linkage with livestock production in Indonesia. This article provides guidelines for new researchers while investigating this area in the future and also provides help to policymakers in developing policies related to resolving livestock production issues.

Keywords: Socio-economic Conditions, Income Level, Education Level, Energy Consumption, CO_2 Emissions, Environmental Conditions, Livestock Production
JEL Classifications: K32, Q01, P48, F64

1. INTRODUCTION

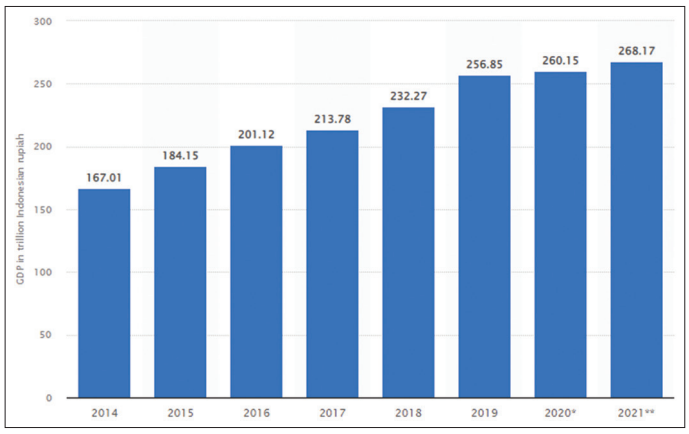
Livestock is considered one of the core sectors for not only developed but also developing countries. The economy of particularly developing countries as well as rural livelihoods heavily rely on livestock. Producers and others involved in sometimes complicated value chains rely on them for revenue and employment. For the impoverished, particularly for women and pastoralist communities, they constitute a vital resource and safety net. Additionally, they are a significant source of food for billions of rural and urban people. Because of multiple socio-economic factors like increasing populations, wages, and urbanization rates, these socioeconomic responsibilities and others are becoming more and more significant as the industry develops (Hatab et al., 2019; Vineer et al., 2020). The industry requires a sizable amount of investment, land, water, biomass, and other resources in order to deliver these advantages. Concerns have been raised about how to control the sector's expansion so that these advantages may be realized at a lesser environmental cost (Ates et al., 2018).

Indonesia is one of the largest Islamic countries with a sound population. Many Indonesian people like eating beef. Indonesia has a growing demand for beef every year. But Indonesia's domestic beef production is insufficient to satisfy those demands. The Indonesian government has taken a number of steps to fulfil demand without importing beef and attain beef self-sufficiency, such as by building a number of facilities for growing beef cattle. The Indonesian government has also 3 times introduced the

Beef Self-Sufficiency Program under the Directorate General of Livestock and Animal Health (DGLAH), namely PSDS 2005, PSDS 2010, and PSDS 2014. However, none of the PSDS's goals was met, and imports still happen despite the failure to attain beef self-sufficiency. There are many reasons highlighted at different points in time but the most common one is the non-availability of accurate information. The government always perceives a stock shortage and imports as a result, one of the causes is the lack of precise data on the country's cattle herd. The government also highlighted that the lack of accurate data on the country's cattle population could result in bias in the formulation of policies (Basyar, 2021; Rasyid et al., 2018). Moreover, there are a number of other factors which cause hurdles in the development of this sector like (1) lack of financial support like livestock loans from the government to the low-income level communities, (2) lack of proper livestock education system, (3) lack of awareness from the government regarding the importance of this sector in terms of contribution in GDP. Thus, there is a need to investigate these issues in order to overcome the barriers to the development of livestock production. The GDP from livestock in Indonesia is given in Figure 1.

The past literature gaps that the present study will address are (1) livestock is considered one of the common businesses for almost every country's low-level income societies. The country's prime aim is to provide a better standard of living to its people, thus, they invest their maximum efforts to bring stability to their economy by supporting these sectors. Although livestock is investigated a lot from different perspectives at different times but still not reached its peak as there are a number of its aspects are need to be explored, (2) Mengistu et al. (2021), worked on the challenges faced by livestock production, particularly in Ethiopia, however, the present investigation will work on livestock production from socio-economic conations point of view in Indonesia countries with fresh data set, (3) the equation consists of livestock production, income level, education level, energy consumption, carbon dioxide emission and economic growth, particularly in Indonesia is not tested before in recent time, (4) Solikin et al. (2019), worked on the livestock production from beet cattle farming point of view, however, the present investigation will work on livestock as a whole from a socio-economic point of view. The significance of the present investigation are (1) shine the spotlight on the livestock production importance for the country's economy as well as for society particularly in Indonesia, (2) will be helpful for the agriculture and the livestock related professional to review their policies with the view to uplift this industry performance, and (3) will help the researchers to explore more aspects pertaining to livestock production particularly in Indonesia.

Figure 1: GDP from Livestock in Indonesia.



Source: Statista

Structurally the paper is divided into different chapters. The overall introduction of the study including the study gap and significance will be presented in the first phase of the study. The second phase will present evidence about livestock production, income level, education level, energy consumption, carbon dioxide emission and economic growth in connection with past studies will be discussed. The third chapter of the study will provide the methodology, i.e., the collection of data about livestock production, income level, education level, energy consumption, carbon dioxide emission and economic growth. After that, the validity of the data will be analyzed. The results received after data analysis will be presented in the fourth chapter. Finally, the study's conclusion, implications and recommendations will be presented.

2. LITERATURE REVIEW

There are multiple income societies falls in the country like low-income, middle-income and high levels of income. Similar is the case with different business levels like businesses for small and medium enterprises and large-scale businesses. Usually, businesses are the combination of both the low class and upper class of society. The level of income of society has an influence on business. Usually, in developing countries, the livestock business is operated in low-level income societies (Hatab et al., 2019; Chien et al., 2022c; Michalk et al., 2019). The income level affects livestock production. In this context, Solikin et al. (2019) worked on the contribution of social capital to livestock development particularly beef cattle farmers. The investigation was carried out in Pakistan. The sample of 180 samples was gathered and tested with the help of multiple sampling tests. The results of the investigation proposed that the ability of the farmers to work together to accomplish group goals revealed that the social capital of beef cattle producers is at a medium level. Further, there is a strong relationship between the social capital and the income of Kediri beef cattle farmers. It suggested that income increased in direct proportion to social capital (Chávez-Pérez et al., 2021; Lan et al., 2022; Liu et al., 2022a). A social gathering and intense training in technological mastery for farmers were two initiatives to boost social capital (Kamarudin et al., 2021; Khattak et al., 2021). Similarly, Mengistu et al. (2021) worked on the challenges faced by livestock production. The investigation was carried out in Ethiopia. The results of the investigation revealed that one of the challenges faced by the low production of livestock is the level of income of the farmers. The study also recommended the government support the low-level income farmers with the view to support this industry.

Human resource is one of the vital parts of any country's prosperity. Educated and skilled human resources are considered an asset of the country. Usually, the industries or sectors of the country's economy are not developed due to not adopting modern-era tools,

and techniques. There is skilled labour required to introduce and implement modern-era technology (Ali et al., 2022; Bai et al., 2022). Thus, the education level is considered one of the vital elements for the betterment of any firm, sector or industry of the country (Chien, 2022b; 2021; Wahidin, 2019). Similar is the case with livestock production. The difference between what farmers really experience and what citizens expect is widening in many nations. It is crucial to close this gap, and this should begin at the elementary school level, as customers and citizens become more and more concerned about the growth of livestock farms. However, there is a dearth of data on the attitudes and understanding of young people and their instructors about livestock output (Chien et al., 2021c; Pham-Duc et al., 2019). In this context, Chouteau et al. (2019) worked on the challenges which result in the reeducation of the gap between the production of livestock and the urban areas ' concerns. The investigation was carried out in France. The investigation gathered a sample of 1087 teachers of schools. The results of the investigation proposed that the education is education plays a vital role in livestock production. Professional with livestock education results in betterment in the livestock reduction in urban areas. Moreover, the investigation emphasizes the need to strengthen the educational materials that are accessible to teachers and to provide future citizens with greater information about cattle farming. At the European level, this conclusion based on the French population has to be expanded. Similarly, Duguma and Debsu (2019), worked on the determinants of the livestock production. The results of the investigation proposed that the education is one of the key determinant of livestock production. The investigation also recommended that the countries should focus on the livestock education with the view to development of the sector.

Energy is considered one of the vital needs of the modern era. It has a strong influence on every sector of the country. Similar is the case with livestock (Chien, 2022a; Chien et al., 2021a; Nawaz et al., 2021). The livestock industry also modernized with the passage of time. It's also demanding more energy. In this context, Elahi et al. (2019) investigated whether energy in any form renewable or non-renewable plays any role in livestock production sustainability. The investigation was carried out in Pakistan. The investigation gathers a sample of 360 cattle animals i.e. buffalos. The gathered sample was analyzed with the help of the ANN test. The results of the investigation proposed that the major sources of energy used in milk production were renewable sources, including millet, minerals, concentrates, and sorghum. Energy inputs were overused, as shown by the energy usage efficiency of 0.08 and the production efficiency of 0.24. Furthermore, if farmers used the recommended inputs, they might save 30.5% of the overall energy input. Electricity was shown to be the least efficient use of energy input among non-renewable energy sources, mostly because of farmers' poor management. Additionally, a unit increase in renewable energy resulted in a 0.02 unit drop in milk output. While a unit increase in non-renewable energy resulted in a 0.01 unit increase in milk output. Moreover, Chandio et al. (2020), also investigated whether there is any association between livestock and energy and carbon emission. The investigation was carried out in China. The investigation used a sample of 26 years ranging from 1990 to 2016. The gathered sample was analyzed with the help of the ARDL test. The results of the investigation proposed that in the long term, carbon emissions are significantly reduced by both agricultural and animal production, respectively. However, electricity use in agricultural and forest areas has a negative impact on it, demonstrating that these factors have a long-term as well as short-term impact on reducing carbon emissions. Additionally, crop productivity, agricultural power use, and forest acreage all have a unidirectional causal relationship with carbon emissions. Livestock output and carbon emissions are causally linked in both directions (Liu et al., 2022b; Sadiq et al., 2022a).

Climate change is caused by a rapid increase in carbon dioxide emissions which further affects agriculture and livestock in the form of food security (Chien et al., 2021b; Sadiq et al., 2022b). However, as a result of agricultural and livestock productivity, emissions continue to increase. Thus, there is an association between carbon emissions and livestock. Rehman et al. (2021), investigated whether livestock production has any association with carbon emission. The study gathers a sample of 30 years ranging from 1988 to 2017. The gathered sample was analyzed with the help of the PP test. The results of the study proposed that in the long run the rainfall and the value added to agriculture have a positive impact on carbon dioxide emissions, whereas the output of cereal crops, animals, and the temperature had a negative impact. Furthermore, in the short run the rainfall, temperature, livestock output, agricultural value-added, and production of cereal crops all significantly affect carbon dioxide emissions. The investigation also recommended that countries pay special attention to livestock with a view to stability in the environment. Similarly, Ayyildiz and Erdal (2021) checked whether there is any sort of association between carbon emission and livestock production in terms of indexes. The study gathered information from 16 years ranging from 1998 to 2014. The gathered sample was tested with the help of the DCCE test. The results of the investigation proposed that a 1% rise in the crop production index has an impact on carbon emissions, especially in nations with lower-middle-class incomes. Further, in nations with lower, higher, and higher income levels, respectively, a 1% rise in the livestock production index causes an increase in carbon emission rates of 0.28, 0.49, and 0.39. Additionally, animal rearing has a greater impact on agricultural production's carbon emissions. Additionally, countries need to adopt more environmentally friendly agricultural technologies, support global environmental policies and improve agricultural production methods to reduce the positive correlation between vegetative and livestock production in accordance with their level of development (Sadiq et al., 2022c; Tan et al., 2021; Zhao et al., 2021). Moreover, Rehman et al. (2021) investigated whether carbon emissions affect climate change, livestock production and forestry. The study was carried out in Pakistan. The investigation gathered a sample of 47 years ranging from 1970 to 20147. The gathered sample was analyzed with the help of the UR test. The results of the study proposed that the production of forests, rainfall, and temperature have a positive long-term impact on carbon dioxide emissions, but the production of crops, animals, energy usage, and population expansion have a negative long-term impact. On the other hand, in the near term, carbon dioxide emissions in Pakistan are positively impacted by forestry output, agricultural and livestock production, population increase, rainfall,

and temperature, while negatively impacted by energy use. Additionally, there is a unidirectional relationship between each variable. To increase agricultural output, the Pakistani government must implement the necessary steps to reduce carbon dioxide emissions.

The economy of any country is the combination of multiple sectors like energy, agriculture, and livestock. Every country in the world has its unique nature some countries are rich in natural resources, others are good in industrialization, and some are narrated as an agricultural country (Hamid et al., 2020; Chien et al., 2022d). These natural gifts are the real contributors to the country's prosperity. Countries which are rich in green land usually prefer livestock. Agriculture-based countries usually prefer the livestock business (Zhao et al., 2022). In this context, Sommer and Knudsen (2021), explored whether livestock affects the economy in Denmark. The results of the study revealed that livestock management contributes to the country's economy in a positive way. There is a positive association between livestock and economic growth in Denmark. Similarly, Rehman et al. (2021) investigated whether livestock production has any association with economic development. The study was conducted in China. The study gathered a sample of 47 years like from 1970 to 2017. The gathered sample was analyzed with the help of ARDL approach. The results of the investigation proposed that whereas the effects of negative shocks are statistically negligible, positive shocks to cereal crop output degrade air quality by amplifying carbon dioxide emissions only over the long term. Changes in forestry have little to no effect on China's carbon dioxide emissions. In addition, carbon dioxide emissions show a high upward correlation with favorable shocks to the energy sources used in the Chinese economy. Moreover, livestock production in China affects economic progress in a positive way. The livestock production is totally based on the different forms of cattle used. The health and life of those cattle are the ultimate priority of the livestock owners. The better and healthy life those cattle have the more the dairy products will be which ultimately contribute to the country's economy in a better way. In this context, De Vries (2017) checked whether the livestock i.e. dairy cattle (in the context of cattle's life and production) have any association with the economic growth of the country. The results of the investigation proposed that healthy cattle results in an increase in livestock production which results in economic prosperity of the country.

3. RESEARCH METHODS

The study investigates the impact of socio-economic conditions such as income and education level, energy consumption, CO_2 emissions, and economic growth on livestock production in Indonesia. The study has taken secondary data from a secondary source like WDI from 1987 to 2020. The researchers have established the equation using the understudy variables given below:

$$LSP_t = \alpha_0 + \beta_1 INL_t + \beta_2 EDL_t + \beta_3 EC_t + \beta_4 CO2E_t + \beta_5 EG_t + e_t \quad (1)$$

Where;
LSP= Livestock Production
t = Time Period
INL= Income Level
EDL= Education Level
EC = Energy Consumption
CO_2E = Carbon Dioxide Emissions
EG = Economic Growth

The study used livestock production as the dependent variable and measured with the livestock production index. In addition, the study used three predictors such as socio-economic conditions measured with net national income (annual percentage growth) and education expenditure (% of GNI), energy consumption measured with energy use (Kg of oil equivalent per capita), and environmental conditions measured with CO2 damages (% of GNI). Finally, the study has taken one control variable named economic growth measured with GDP growth annual percentage. These variables, sources, and measurements are given in Table 1.

The present study has checked the details of the variables using descriptive statistics. Moreover, the present research also checked the correlation among variables using a correlation matrix. In addition, the present article also checked the stationarity using Augmented Dickey-Fuller Test (ADF), which is necessary to apply the appropriate model. The equation for the ADF test is given below:

$$d(Y_t) = \alpha_0 + \beta t + \mathrm{Y} Y_{t-1} + d(Y_t(-1)) + \varepsilon_t \quad (2)$$

In addition, the ADF test checks the stationarity individually. Hence, the separate equations for variables are given below:

Livestock Production

$$d(LSP_t) = \alpha_0 + \beta t + \mathrm{Y} LSP_{t-1} + d(LSP_t(-1)) + \varepsilon_t \quad (3)$$

Income Level

$$d(GINL_t) = \alpha_0 + \beta t + \mathrm{Y} INL_{t-1} + d(INL_t(-1)) + \varepsilon_t \quad (4)$$

Education Level

$$d(EDL_t) = \alpha_0 + \beta t + \mathrm{Y} EDL_{t-1} + d(EDL_t(-1)) + \varepsilon_t \quad (5)$$

Energy Consumption

$$d(EC_t) = \alpha_0 + \beta t + \mathrm{Y} EC_{t-1} + d(EC_t(-1)) + \varepsilon_t \quad (6)$$

Table 1: Variables with measurements

S#	Variables	Measurement	Sources
01	Livestock production	Livestock production index (2014-16=100)	WDI
02	Level on income	Net national income (Annual percentage growth)	WDI
03	Level of education	Education expenditure (% of GNI)	WDI
04	Energy consumption	Energy use (Kg of oil equivalent per capita)	WDI
04	Environmental conditions	CO2 damages (% of GNI)	WDI
05	Economic growth	GDP growth annual percentage	WDI

CO_2 Emissions

$$d(CO2E_t) = \alpha_0 + \beta t + \mathrm{Y}CO2E_{t-1} + d(CO2E_t(-1)) + \varepsilon_t \quad (7)$$

Economic Growth

$$d(EG_t) = \alpha_0 + \beta t + \mathrm{Y}EG_{t-1} + d(EG_t(-1)) + \varepsilon_t \quad (8)$$

The study has also checked the connection among the variables using the ARDL model because the understudy variables are stationary at I(0), and at I(1). The ARDL model is an appropriate model when variables have no unit root at I(0) and at I(1) (Ainou et al., 2022; Haroon et al., 2021; Mensah et al., 2019). In addition, the ARDL model provides the long as well as the short-run connection among the variables. Finally, the ARDL model controls the general problems of heteroscedasticity and auto-correlation. The estimated equation for the ARDL approach is given below:

$$\Delta LSP_t = \alpha_0 + \sum \delta_1 \Delta LSP_{t-1} + \sum \delta_2 \Delta INL_{t-1} + \sum \delta_3 \Delta EDL_{t-1} + \sum \delta_4 \Delta EC_{t-1} + \sum \delta_5 \Delta CO2E_{t-1} + \sum \delta_6 \Delta EG_{t-1} + \varphi_1 LSP_{t-1} + \varphi_2 INL_{t-1} + \varphi_3 EDL_{t-1} + \varphi_4 EC_{t-1} + \varphi_5 CO2E_{t-1} + \varphi_6 EG_{t-1} + \varepsilon_1 \quad (9)$$

4. RESEARCH FINDINGS

The present study has checked the details of the variables using descriptive statistics. The outcomes revealed that the LSP mean value was recorded 79.722%, while INL average value was −38.340% and EDL mean value was 1.976%. In addition, the outcomes also revealed that the EC mean value was recorded 745.016 kg of oil equivalent per capita, while the CO_2E average value was 2.316% and EG mean value was 4.383%. These figures are given in Table 2.

Moreover, the present research also checked the correlation among variables using a correlation matrix. The outcome indicated that the INL, EDL, EC, and EG have a positive linkage with LSP, while CO_2E has a negative association with LSP. These figures are given in Table 3.

Table 2: Descriptive statistics

Variable	Obs	Mean	Std. Dev	Min.	Max
LSP	34	79.722	36.576	40.640	174.920
INL	34	−38.340	160.592	−652.324	234.066
EDL	34	1.976	1.093	0.485	3.270
EC	34	745.016	148.876	436.736	959.687
CO_2E	34	2.316	0.798	1.629	4.980
EG	34	4.838	3.697	−13.127	8.220

Table 3: Matrix of correlations

Variables	LSP	INL	EDL	EC	CO_2E	EG
LSP	1.000					
INL	0.085	1.000				
EDL	0.722	−0.051	1.000			
EC	0.785	0.013	0.900	1.000		
CO_2E	−0.109	−0.255	0.003	0.076	1.000	
EG	0.118	0.131	−0.079	−0.123	−0.727	1.000

In addition, the present article also checked the stationarity using ADF, which is necessary to apply the appropriate model. The figures exposed that the INL, EDL, and EC are stationary at a level while LSP, CO_2E, and EG are stationary at first difference. These figures are given in Table 4.

In addition, the present article also checked the co-integration using ARDL bound test, which is also necessary to apply the appropriate model. The findings revealed that the calculated f-statistics (5.92) are higher than critical values at 5 percent significance level. The figures exposed co-integration exists. These figures are given in Table 5.

The findings exposed that the socio-economic conditions such as income and education level, energy consumption, and economic growth have a positive while CO_2 has a negative linkage with livestock production in Indonesia in the short-run. These linkages are given in Table 6.

The findings exposed that the socio-economic conditions such as income and education level, energy consumption, and economic growth have a positive while CO_2 has a negative linkage with livestock production in Indonesia in the long-run. These linkages are given in Table 7.

5. DISCUSSION

The results showed that income level has a positive relation to livestock production. These results agree with the past study

Table 4: Unit root test

Augmented dickey-fuller test (ADF)	Level	t-statistics	P-values
LSP	I (1)	–4.903	0.011
INL	I (0)	–3.832	0.023
EDL	I (0)	–3.104	0.031
EC	I (0)	–2.119	0.041
CO_2E	I (1)	–6.893	0.000
EG	I (1)	–5.772	0.000

Table 5: ARDL bound test

Model	F-statistics	Lag	Level of significance	Bound test critical values	
				I (0)	I (1)
LSP/(INL, EDL, EC, CO_2E, EG)	5.92	4	1%	6.73	6.91
			5%	5.11	5.67
			10%	4.32	4.76

Table 6: Short run coefficients

Variable	Coefficient	SE	t-Statistic	Prob.
D (INL)	3.092	1.011	3.058	0.002
D (EDL)	1.287	0.309	4.165	0.000
D (EC)	2.763	1.012	2.730	0.012
D (CO_2E)	–2.901	1.014	–2.861	0.010
D (EG)	1.927	0.876	2.199	0.021
CointEq(–1)*	–1.627	0.282	–5.769	0.000
R-squared	0.554	Mean dependent var		–0.032
Adjusted R-squared	0.512	S.D. dependent var		2. 231

Table 7: Long term coefficients

Variable	Coefficient	SE	t-Statistic	Prob.
INL	3.902	1.013	3.852	0.002
EDL	2.875	1.201	2.393	0.043
EC	3.878	0.905	4.285	0.000
CO_2E	–2.873	1.028	–2.795	0.031
EG	3.103	1.073	2.892	0.029
C	1.767	0.291	6.072	0.000

of Balehegn et al. (2020), which highlights that increase in the income level, indicates higher profitability of the firms. It enables them to hire the services of efficient labor, high-quality import feed, and employees' innovative breeding techniques. As a result of all these innovations and improvements, livestock production has increased. So, the increasing income level enhances livestock production. These results are also in line with the study of Enahoro et al. (2018). The previous study posits that when in a country, the income level rises, and the individuals have a higher, better living standard. When the purchasing power of the country increases, the demand for livestock products also increases and results in greater livestock production. Thus, the income level positively contribute to livestock production.

The results indicated that education level has a positive relation to livestock production. These results agree with the past study of Alemayehu et al. (2021), which examines the education role in livestock production. This study explains that when the government issues its policies for promoting education levels within the country, there is an improvement in human capital formation. This results in administration and labor improvement for the livestock industry, and the production processes can be improved to gain better livestock production. These results are also in line with the study of Do et al. (2019), which proclaims that the increasing education level produces knowledgeable and skilled ranchers who can better understand the weaknesses in livestock breeding and have the ability to boost live production. Hence, the rising education level increases livestock production.

The results showed that energy consumption has a positive relation to livestock production. These results match with the past study of Elahi et al. (2019), which shows that when the total energy consumption increases within the country, work increases in different economic sectors. Many firms which are engaged in the consumption of livestock commodities for production processes require raw material livestock breeding firms. The increasing demand for livestock production enhances motivation for livestock production. So, there is increasing livestock production as a result of higher energy consumption. These results are also in line with the study of Rehman et al. (2021), which claims that in the country where the use of energy increases within the country, there is activity within the economy, and people have a prosperous life. In these circumstances, the requirement for livestock commodities for food and clothing purposes increases. The increasing demand could bring higher profits for the ranchers and motivate them to increase livestock production.

The results revealed that CO_2 emission has a negative relation to livestock production. These results agree with the past study of Chandio et al. (2020), which reveals that the increasing amount of CO_2 emissions destroys the quality of the atmosphere. The affected climate is not suitable for the living creatures like cattle, pigs, goats, horses, donkeys, mules, buffalo, and camels to survive and reproduce. Hence, in an environment affected by CO_2 emissions, higher livestock production is unable to be produced. So, the increasing CO_2 emission results in a decrease in livestock production. These results are also in line with the study of Lu et al. (2020) which examines the impacts of CO_2 emission and livestock production. The study posits that increasing CO_2 emissions is a great threat to livestock production. In a situation the atmosphere is affected by CO_2 emissions, it becomes difficult for ranchers to properly feed and look after the livestock, and the living stock may get diseases in a polluted environment. Consequently, livestock production is lower. Hence, the increase in CO_2 emissions reduces livestock production.

The results showed that economic growth has a positive relation to livestock production. These results agree with the past study of Ridzuan et al. (2020), which demonstrates that when a country is making higher economic growth, the livestock farms have the ability to afford the advanced technologies for livestock breeding. Even they can import technologies helpful in livestock production. Hence, the total production of livestock can be enhanced, and the quality of livestock production also improves. These results are also in line with the study of Marques et al. (2018), which indicates that in case the country is making higher economic growth, the production activities in all the economic sectors are higher. So, the requirement for livestock commodities and services increases within the economy, and it triggers the improvement in livestock handling. As a result, livestock production increases.

5.1. Theoretical Implication

The current study has suitable guidelines for scholars because it makes a significant contribution to the literature. The study examines the influences of socio-economic factors like income level and education level, energy consumption, and CO_2 emissions, along with economic growth on livestock production. In the previously conducted literature, the impacts of income level, education level, energy consumption, CO_2 emissions, and economic growth on livestock production. But these studies have addressed the relationships among these factors individually and separately. The present study makes a distinction in literature by analyzing the impacts of income level and education level, energy consumption, and CO_2 emissions along with economic growth on livestock production simultaneously. The current study also makes a significant contribution to the literature by analyzing the role of income level and education level, energy consumption, and CO_2 emissions along with economic growth in livestock production for the Indonesian country.

5.2. Empirical Implication

The current study has great significance to emerging economies like Indonesia. It throws light on livestock production that provides the raw material for food processing and many other manufacturing factors, as well as renders different services. The current study has guidelines for economists and state authorities on how livestock production can be increased. The study guides that such economic

and fiscal policies should be formed as the income level of the firms and individuals can be raised, and thereby, livestock production can be improved. The study also suggests that government must apply effective strategies to encourage high-level education for adolescents prior to professional lives or job holders so that livestock production can be enhanced. Similarly, the government, with the cooperation from economists and regulators, must manage energy consumption or try to promote more appropriate alternatives to traditional energy in order to allow the high growth of livestock production. This article provides guidelines for new researchers while investigating this area in the future and also provides help to policymakers in developing policies related to resolving livestock production issues. It has been highlighted that the environmental quality must be improved by reducing CO_2 emissions because a good quality environment can increase livestock production. Moreover, it also guides the country to increase economic growth to achieve higher livestock production.

6. CONCLUSION

The present study aimed to explore the impacts of income level and education level, energy consumption and environmental conditions, along with economic growth in livestock production. The quantitative data for the income level and education level, energy consumption and CO_2 emissions, economic growth and livestock production were collected from the Indonesian economy. Using the empirical information, the results of the study were found. These results showed that income level and education level, energy consumption and economic growth have a positive relation to livestock production. The results revealed that if the increasing income level, there is more employment rate, more labor is available to render services, and firms can spend more to boost their businesses. This enhances the demand for ad facilitates the production of livestock. The results also showed that the increasing education opportunities and improvement in education quality are helpful in producing economic actors with updated knowledge and skills to breed livestock efficiently and enhance total livestock production. Likewise, the use of energy enables firms to run business processes and apply different technologies. The increasing use of energy facilitates the production of livestock, and the increasing demands also boost livestock production. The authors found that in case there is an increasing economic growth rate, better technologies, raw materials, and services are in hand as well, as there is more demand for livestock commodities. Hence, livestock production increases. Moreover, CO_2 emission was found to be in a negative relation to livestock production. The increasing CO_2 emission adversely affects the environment and feed for the animals and, therefore, reduces livestock production.

There are several limitations linked to the current study. These limitations are expected to be overcome in further literature when the authors make their extra efforts. The study examines only a limited number of factors like income level and education level, energy consumption and CO_2 emissions, and economic growth for the analysis of livestock production. The study is as much comprehensive as it must be to meet the needs of the readers. Considering this, scholars must increase the number of variables which have an influence on livestock production. The livestock production on account of income level, education level, energy consumption, CO_2 emissions, and economic growth has been analyzed in the Indonesian economy alone. The single-country statistics cannot be enough to give accurate and general findings. Therefore, it is recommended to future authors that they must collect quantitative data from multiple countries for accurate and general findings regarding the relationship between income level, education level, energy consumption, CO_2 emissions, economic growth, and livestock production.

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