CHARACTERIZATION OF POPULATION PRESSURE – ANIMAL PRODUCTION CYCLE TO GREENHOUSE GAS EMISSION

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Abstract

This study aims to evaluate the impact of population pressure on carbon dioxide emission. The study made use of a path analysis to test the fit of the correlation matrix against two or more causal models which are being compared. The model is usually depicted in a circle-and-arrow figure in which single-headed arrows indicate causation. A regression is done for each variable in the model as a dependent on others which the model indicates are causes. The study concludes that population control is the key to minimizing the carbon dioxide emission accumulated in the atmosphere. Population pressure pushes the increase in beef production which in turn adds to the carbon dioxide concentration in the atmosphere. Correspondingly, increased population directly contributes to carbon dioxide emission. The researcher also found out that each additional human individual equates to three (3) cattle raised in terms of their relative carbon dioxide contribution in the earth's atmosphere. Thus, an unregulated cattle industry that does not take into account limits on the number of cattle raised domestically based on human population growth is likely to lead to adverse impacts on climate change.

Keywords: *path analysis, population pressure, beef productivity, carbon dioxide*

1.0 Introduction

Food production is still the most important concern around the globe. According to United Nation (2015) the demand for food will be quadrupled in the 2050. With increased affluence, people are eating more animal meat and other animal products annually, according to a United Nations report (Steinfeld, 2006). With the increasing demand of livestock products for high quality animal protein, the animal industry globally continues growing. This high demand for livestock products is likely to have an undesirable impact on the environment. Productivity of beef involves the use of machinery and more industrialized which can lead to producing more greenhouse gases which can also affect the ozone layer and trigger global warming. Also, the manure of the ruminant like cattle, is a significant source of GHG emission, a great contributor of today's serious environmental problem (UN-FAO, 2006). United Nation (2015) warns that the increase of the number of livestock causes more serious problems in the atmosphere, hence, there must be a mitigation on the production of food to lessen its negative impact to the environment. The cattle industry provides the most common source of high quality animal protein. Beef is one of the most consumed meats worldwide followed by carabeef, Chevon and mutton. Since, production of beef is needed for the production of animal protein; this study aims to evaluate the impact of population pressure to the productivity of beef.

The environmental impact of meat production varies because of the wide variety of agricultural practices employed around the world. All agricultural practices have been found to have a variety of effects on the environment. Some of the environmental effects that have been associated

with meat production are pollution through fossil fuel usage, animal methane, effluent waste, and water and land consumption. The 2006 report Livestock's Long Shadow, released by the Food and Agriculture Organization (FAO) of the United Nations, states that "the livestock sector is a major stressor on many ecosystems and on the planet as a whole. Globally it is one of the largest sources of greenhouse gases and one of the leading causal factors in the loss of biodiversity, while in developed and emerging countries it is perhaps the leading source of water pollution. Some fraction of these effects is assignable to non-meat components of the livestock sector, such as the wool, egg and dairy industries, and to the livestock used for tillage. Livestock has been estimated to provide power for tillage of as much as half of the world's cropland. According to production data compiled by the FAO, 74 percent of global livestock product tonnage in 2011 was accounted for by non-meat products such as wool, eggs and milk.

There has been an increasing pressure on the livestock sector to meet the growing demand for high-value animal protein. The world's livestock sector is growing at an unprecedented rate and the driving force behind this enormous surge is a combination of population growth, rising incomes, and urbanization. Human intervention in livestock production practices is necessary to promote sustainable livestock production in many parts of the world. This sector promotes the increasing production of CO_2. The Carbon dioxide is a significant factor affecting the shifting of weather patterns. Consequently, animal productions today are more industrialized than the previous production practices which uses more of the machinery for faster production. It involves using equipment in planting forage, hauling and product processing. Also, deforestation is correlated with increasing the production of CO_2 due to establishing of pasture and building of farm facilities.

Modern agricultural science stresses conservation and preservation constraints while finding ways of maximizing yields. According to Hermansen, et al. (2011) livestock production is the largest methane and CO_2 source emitter in the world. Most of these greenhouse gases are a result of manure storage and enteric fermentation, which is produced in the digestive tract of an animal. Assessing global livestock and animal production practices can be one of the remedy in reducing the GHG emission in the atmosphere. It will lessen the environmental problem cause of animal production. The industrialization in livestock production practices must ensure environmental sustainability while maximizing agricultural production (Bernardo, 1997).

2.0 Conceptual Framework

CO_2 emission is directly affected by population pressure and animal production. There are two paths which CO_2 emission is affected; Path 1, with the increasing population, the consumption also increases which pushes the production to boost in order to meet the demand and this increasing production leads to a large amount of CO_2 emission; and Path 2, population pressure directly increases the CO_2 emission. The production of beef in a current situation did not meet the demand of huge populations. Carbon dioxide is the major product in every human activity. It includes in farm management like waste management and uses of farm machineries. Domestication of animals for human consumption accounts for approximately 40% of the total amount of agricultural output in industrialized countries. Changes in demand for meat may

change the environmental impact of meat production by influencing how much meat is produced. Production sector assumed the high emission of CO_2 and have a significant impact on the environment. Schematic diagram of the study is shown below.

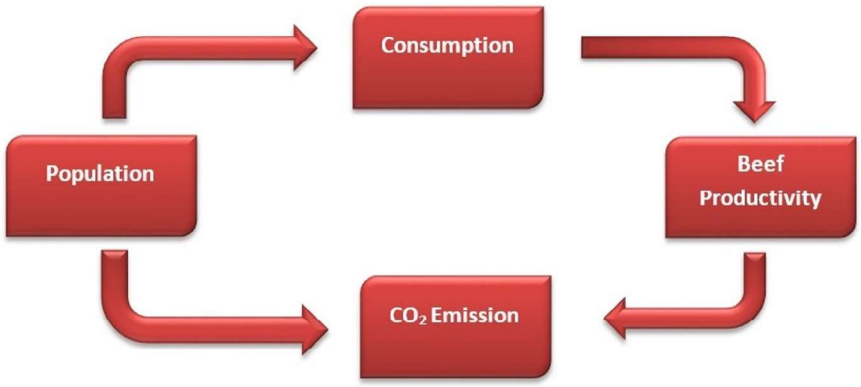

Figure 1. Schematic Diagram of the Study.

3.0 Research Design and Methods

The study employed the descriptive design to assess the direct and indirect impact of population pressure to beef productivity. This study made use of a path analysis to test the fit of the correlation matrix against two or more causal models which are being compared. The model is usually depicted in a circle-and-arrow figure in which single-headed arrows indicate causation. A regression is done for each variable in the model as a dependent on others which the model indicates are causes.

A path coefficient is a standardized regression coefficient (beta) showing the direct effect of an independent variable on a dependent variable in the path model. Thus, when the model has two or more causal variables, path coefficients are partial regression coefficients which measure the extent of the effect of one variable on another in the path model controlling for other prior variables, using standardized data or a correlation matrix as input. The data were obtained from the World Bank Data on CO_2 emission, human population, consumption and beef production in 50 countries worldwide (Worldbank, 2016). The data were subjected to statistical software (Minitab) for processing. The data are standardized to make a uniform data set for data correlation and regression.

4.0 Result and Discussion

Table 1 shows the regression analysis of 50 countries in relation to CO_2 emission affecting the factors namely; Production and Population.

Table 1. Regression Analysis: CO_2 Emission (KT) versus Population, Production (MT)

The regression equation is
CO2 Emission (KT) = 0.0000 + 0.310 Production(MT) + 0.611 population

Predictor	Coef	SE Coef	T	P
Constant	0.00000	0.07777	0.00	1.000
Production	0.3101	0.1016	3.05	0.004
population	0.6111	0.1016	6.02	0.000

S = 0.5499 R-Sq = 71.0% R-Sq(adj) = 69.8%

Tabular values reveal that population pressure increases carbon dioxide emission into the atmosphere jointly with increased production of beef. The direct effects of population pressure and beef production on carbon dioxide emission are, 0.6111 and 0.3101, respectively. It can be noted that the direct effect of increased population is double that of the direct effect of beef production on carbon dioxide emission.

There is a cycle or a path that leads to carbon dioxide emission starting from population pressure, namely: population pressure to consumption, to beef production, and to carbon dioxide emission. Table 2 shows that increase in population corresponds to an increase in the consumption of beef. The path weight for this segment is given by 0.573

Table 2: Path Weight for the Segment Population to Consumption

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The regression equation is
Consumption(MT) = 0.000 + 0.573 population

Predictor        Coef     SE Coef          T        P
Constant       0.0000      0.1171       0.00    1.000
populati       0.5729      0.1183       4.84    0.000

S = 0.8281      R-Sq = 32.8%     R-Sq(adj) = 31.4%
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On the other hand, the path weight for the segment consumption to beef productivity is 0.958 as shown in Table 3:

Table 3: Path Weight for the Segment Consumption to Beef Production

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The regression equation is
Production(MT) = - 0.0000 + 0.958 Consumption(MT)

Predictor        Coef     SE Coef          T        P
Constant     -0.00000     0.04077      -0.00    1.000
Consumpt      0.95843     0.04118      23.27    0.000

S = 0.2883      R-Sq = 91.9%     R-Sq(adj) = 91.7%
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The total indirect effect of population pressure to carbon dioxide emission is shown in Table 4:

Table 4: Indirect Effect of Population Pressure to Carbon Dioxide Emission

Segment 1	Segment 2	Segment 3	Effect	Nature of Effect
Population to Consumption .573	Consumption to Beef Production .958	Beef Production to CO2 Emission .698	.3832	Indirect
Population to CO2 Emission			.8080	Direct
		Total	1.1912	Total Causal

Tabular values indicate that the direct effect of population growth on the accumulation of carbon dioxide in the atmosphere almost tripled in its indirect effect. Production of beef contributes a third of the carbon dioxide emission in response to increased demand for beef due to population increase. In other words, the carbon dioxide emission for every three cattle raised approximates the carbon dioxide emission

of one person born throughout his/her lifetime.

5.0 Conclusion

The study concludes that population control is the key to minimizing the carbon dioxide emission accumulated in the atmosphere. Population pressure pushes the increase in beef production which in turn adds to the carbon dioxide concentration in the atmosphere. Correspondingly, increased population directly contributes to carbon dioxide emission. The researcher also found out that each additional human individual equates to three (3) cattle raised in terms of their relative carbon dioxide contribution in the earth's atmosphere. Thus, an unregulated cattle industry that does not take into account limits on the number of cattle raised domestically based on human population growth is likely to lead to adverse impact on climate change.

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