Livestock Emission Reduction Policies and their Impact on Greenhouse Gas Emissions in Peru

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Abstract

Purpose: The aim of this study was to explore the livestock emission reduction policies and their impact on greenhouse gas emissions in Peru.

Materials and Methods: The study adopted a desktop research methodology. Desk research refers to secondary data or that which can be collected without fieldwork. Desk research is basically involved in collecting data from existing resources hence it is often considered a low cost technique as compared to field research, as the main cost is involved in executive's time, telephone charges and directories. Thus, the study relied on already published studies, reports and statistics. This secondary data was easily accessed through the online journals and library.

Findings: The findings revealed that reveal that these policies hold promise in mitigating greenhouse gas emissions associated with livestock farming, but their effectiveness varies by region and context. In the United States, stringent policies resulted in reduced methane emissions, emphasizing the importance of consistent implementation. In the European Union, policy effectiveness varied across member states, underscoring the need for knowledge sharing. In India, policies had mixed socioeconomic impacts, calling for targeted support. In the Brazilian Amazon, policies reduced livestock emissions but inadvertently contributed to deforestation, highlighting the importance of integrated approaches. New Zealand's policies encouraged effective dairy farming practices, while Argentina found that rotational grazing supported emission reduction. Australia's sustained policies led to national emissions reductions. These findings emphasize the need for region-specific policy design, long-term monitoring, knowledge dissemination, and policy continuity to address livestock-related greenhouse gas emissions effectively.

Implications to Theory, Practice and Policy: The Theory of Environmental Policy and Regulation, Theory of Sustainable Agriculture & Theory of Behavioral Change and Adoption may be used to anchor future studies on the livestock emission reduction policies and their impact on greenhouse gas emissions in Peru. There is a need for continued research and monitoring to assess the long-term impacts of these policies and to identify innovative and context-specific emission reduction strategies. Additionally, stakeholders should prioritize knowledge sharing and capacity building to ensure that farmers and communities can effectively adopt sustainable practices encouraged by these policies. Lastly, policy continuity and stability are crucial for achieving sustained reductions in emissions, and governments should commit to their climate targets while adapting policies as needed to achieve optimal results.

Keywords: *Livestock, Emissions, Policies, Greenhouse & Impact*

1.0 INTRODUCTION

Greenhouse gas emissions have become a pressing global concern, with significant implications for climate change and environmental sustainability. These emissions encompass a variety of gases, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases, all of which contribute to the greenhouse effect, trapping heat within the Earth's atmosphere and leading to global warming. Over the past few decades, there has been a substantial increase in greenhouse gas emissions, primarily driven by human activities such as the burning of fossil fuels for energy, industrial processes, and agricultural practices. According to recent statistics, global CO_2 emissions reached a record high of 36.5 billion metric tons in 2019, with methane and nitrous oxide emissions also on the rise (Le Quéré, Jackson, Jones, Smith, Abernethy, Andrew & Canadell, 2020). These alarming trends underscore the urgency of implementing effective policies and strategies to reduce greenhouse gas emissions and mitigate the impact of climate change.

Greenhouse gas emissions in developed economies, such as the United States, Japan, and the United Kingdom, have been a significant contributor to global climate change. In the United States, for instance, carbon dioxide (CO_2) emissions from fossil fuel combustion have been a prominent source of concern. According to data from the U.S. Environmental Protection Agency (EPA), in 2019, the United States emitted approximately 5.41 billion metric tons of CO_2, with the energy sector being the largest contributor, accounting for 60% of total emissions (EPA, 2020). Similarly, in Japan, greenhouse gas emissions have been primarily driven by energy consumption, particularly in the industrial and transportation sectors. In 2018, Japan's total greenhouse gas emissions amounted to 1.29 billion metric tons of CO_2 equivalent, with industry being the largest source, responsible for 39% of emissions (Ministry of the Environment Japan, 2020). In the United Kingdom, emissions have seen a declining trend due to efforts to transition to cleaner energy sources and improved energy efficiency. In 2019, the UK emitted 361.1 million metric tons of CO_2, marking a substantial decrease from previous years (Department for Business, Energy & Industrial Strategy, 2020). These examples highlight the variation in emission profiles and trends among developed economies.

Developing economies, including countries like South Africa, Nigeria, and Kenya, face unique challenges regarding greenhouse gas emissions. In South Africa, a major emitter in Africa, energy production from coal has been a dominant source of emissions. According to data from the Department of Environment, Forestry and Fisheries of South Africa, the country emitted 512 million metric tons of CO_2 equivalent in 2017, with the energy sector contributing 80% of total emissions (DEFF, 2020). In Nigeria, a growing population and energy demand have driven an increase in emissions, primarily from the energy and agriculture sectors. In 2017, Nigeria's total greenhouse gas emissions reached 492 million metric tons of CO_2 equivalent, with the energy sector contributing 49% (Nigeria INDC, 2020). In Kenya, efforts to expand access to electricity have led to a rise in emissions, largely from the energy and transportation sectors. In 2018, Kenya's greenhouse gas emissions were approximately 68 million metric tons of CO_2 equivalent (Kenya National Bureau of Statistics, 2020). These examples underscore the challenges faced by developing economies in balancing economic growth with emissions reduction.

In sub-Saharan economies like South Africa, Nigeria, and Kenya, greenhouse gas emissions have exhibited diverse patterns and trends. South Africa, as a middle-income country with a well-established industrial base, has had comparatively higher emissions. In 2017, South Africa's emissions were 512 million metric tons of CO_2 equivalent, primarily from the energy sector

(DEFF, 2020). Nigeria, an oil-rich nation, has also seen increasing emissions due to its growing energy demands. In 2017, Nigeria's emissions reached 492 million metric tons of CO2 equivalent, with the energy sector being a major contributor (Nigeria INDC, 2020). Kenya, on the other hand, is a lower-middle-income country with emissions of approximately 68 million metric tons of CO2 equivalent in 2018, mainly driven by energy and transportation (Kenya National Bureau of Statistics, 2020). These sub-Saharan economies face the dual challenge of addressing emissions while promoting economic development.

Greenhouse gas emissions represent a critical environmental issue characterized by the release of various gases, including carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and fluorinated gases into the Earth's atmosphere. These emissions result from human activities, such as burning fossil fuels for energy, industrial processes, deforestation, and agricultural practices, and they play a central role in the phenomenon of global warming and climate change. The greenhouse effect, driven by these emissions, involves the trapping of heat within the atmosphere, which leads to an increase in global temperatures. The consequences of elevated greenhouse gas concentrations are multifaceted, encompassing rising sea levels, more frequent and severe weather events, disruptions in ecosystems, and threats to food security and water resources. Consequently, addressing greenhouse gas emissions is a paramount concern for sustainable development and the preservation of the planet's ecological balance (IPCC, 2021).

Livestock emission reduction policies encompass a range of strategies aimed at curbing greenhouse gas emissions associated with livestock farming. Four key policies include improved animal management practices, such as dietary modifications and enhanced breeding techniques, sustainable land use and pasture management, the adoption of manure management technologies, and the promotion of alternative feed sources, like algae-based feeds (Saadaoui, Rasheed, Aguilar, Cherif, Al Jabri, Sayadi & Manning, 2021). These policies directly address emissions linked to livestock production, primarily methane (CH4) emissions from enteric fermentation and manure management. Improved animal management practices reduce methane production from the digestive systems of livestock, while sustainable land use and manure management mitigate emissions from animal waste. Additionally, the use of alternative feed sources can reduce the carbon footprint of livestock farming by decreasing the emissions associated with conventional feed production. By implementing these policies, countries can effectively reduce greenhouse gas emissions from the livestock sector, contributing to broader climate change mitigation efforts and promoting sustainable agricultural practices.

Livestock emission reduction policies in Peru aim to mitigate the environmental impact of the livestock sector on greenhouse gas emissions. These policies typically include measures such as improved animal management practices, sustainable land use, and the promotion of alternative livestock feed sources. In Peru, which has a significant agricultural and livestock industry, these policies are crucial for addressing emissions from livestock-related activities, such as enteric fermentation and manure management (Raihan, 2023). The impact of such policies in Peru can lead to reduced methane emissions, enhanced carbon sequestration, and overall contribute to the country's efforts to combat climate change and promote sustainable agriculture while supporting rural livelihoods.

Statement of the Problem

The problem addressed by the study on "Livestock Emission Reduction Policies and their Impact on Greenhouse Gas Emissions" lies at the intersection of environmental sustainability and agricultural practices. In many countries, including developed and developing economies, greenhouse gas emissions from the livestock sector have been steadily rising due to various factors, including increased meat consumption, population growth, and the expansion of livestock farming. These emissions primarily consist of methane (CH_4) from enteric fermentation in the digestive systems of livestock and emissions from manure management practices. This problem is evidenced by a substantial increase in greenhouse gas emissions associated with livestock farming, contributing significantly to global climate change (Raihan, Muhtasim, Farhana, Hasan, Pavel, Faruk & Mahmood, 2023).

The adverse effects of climate change, such as extreme weather events, sea-level rise, and disruptions in agricultural production, affect a wide range of stakeholders, from farmers and food producers to policymakers and the general population. The problem is twofold: firstly, elevated greenhouse gas emissions from the livestock sector exacerbate climate change, which has far-reaching consequences for environmental sustainability, food security, and global stability. Secondly, the existing knowledge gaps related to the effectiveness of livestock emission reduction policies hinder informed decision-making and the formulation of evidence-based policies. To address this problem comprehensively, it is essential to investigate the impact of various livestock emission reduction policies on greenhouse gas emissions and assess their effectiveness. This study aims to bridge the research gap by providing empirical evidence on the outcomes of these policies, ultimately informing policymakers and stakeholders about the most effective strategies to mitigate livestock-related greenhouse gas emissions.

2.0 LITERATURE REVIEW

Theoretical Review

Theory of Environmental Policy and Regulation

This theory, often associated with scholars like Elinor Ostrom and Garrett Hardin, focuses on the role of government policies and regulations in addressing environmental challenges. It explores how government interventions, such as emission reduction policies, impact human behavior, resource management, and environmental outcomes. This theory is highly relevant as it provides insights into the effectiveness of government policies and regulations, including livestock emission reduction policies, in mitigating greenhouse gas emissions. It helps analyze the design, implementation, and enforcement of these policies and their influence on stakeholders' behaviors and environmental outcomes (Ostrom, 2005).

Theory of Sustainable Agriculture

Originating from thinkers like Wes Jackson and Wendell Berry, this theory emphasizes the need for sustainable agricultural practices that balance economic profitability, social equity, and environmental stewardship. It explores how agricultural systems can minimize negative environmental impacts, including greenhouse gas emissions, while ensuring long-term productivity. This theory is pertinent because it provides a framework for evaluating livestock emission reduction policies in the context of sustainable agriculture. It helps assess how policies

align with the principles of sustainability and whether they promote practices that reduce emissions while maintaining food security and economic viability (Berry, 2019).

Theory of Behavioral Change and Adoption

Grounded in the work of psychologists like Albert Bandura, this theory examines how individuals and communities adopt new behaviors and technologies. It considers factors such as motivation, information, social norms, and incentives in driving behavioral change. This theory is crucial for understanding how livestock farmers and other stakeholders respond to emission reduction policies. It helps identify barriers and facilitators to policy adoption and compliance, shedding light on the human dimensions of policy implementation and its impact on greenhouse gas emissions (Bandura, 2004).

Empirical Review

Smith (2017) Assessed the effectiveness of livestock emission reduction policies in the United States. This study, conducted in the United States, aimed to evaluate the impact of government livestock emission reduction policies on greenhouse gas emissions from the agricultural sector. The researchers analyzed emissions data from livestock operations over a 10-year period, comparing regions with different policy implementations. The study found that regions with stricter emission reduction policies had significantly lower methane emissions from livestock compared to regions with less stringent policies. The findings support the effectiveness of livestock emission reduction policies and emphasize the need for their consistent implementation and enforcement.

European Commission (2018) compared the impact of livestock emission reduction policies across different EU member states. Researchers conducted interviews and surveys with policymakers, farmers, and environmental experts in multiple countries to assess policy implementation and outcomes. The study revealed variations in policy effectiveness, with countries like Denmark and the Netherlands achieving substantial emissions reductions, while others lagged behind. The research highlighted the importance of knowledge sharing and policy adaptation between member states to optimize emission reductions.

Kumar (2019) assessed the socioeconomic effects of livestock emission reduction policies on rural communities. Researchers conducted surveys and focus group discussions with farmers in selected regions to understand how policies influenced their livelihoods. The policies had mixed impacts, with some farmers benefiting from incentives for sustainable practices, while others faced challenges in adapting to new regulations. The study suggested the need for targeted support and capacity building to ensure policy effectiveness and minimize adverse effects.

Silva (2020) focused on the Brazilian Amazon and aimed to evaluate the role of livestock emission reduction policies in curbing methane emissions and deforestation. Researchers used remote sensing data, interviews with farmers, and policy analysis to assess policy outcomes. While policies reduced methane emissions from livestock, they also led to land-use changes and increased deforestation as farmers sought new grazing areas. The study emphasized the need for integrated policies that consider both emissions reduction and forest conservation.

Meadows (2018) evaluated the influence of livestock emission reduction policies on dairy farming practices and emissions. Researchers conducted on-farm assessments and interviews with dairy farmers to understand how policies shaped their management practices. The study revealed that

policies encouraging feed management and methane inhibitors had a positive impact on reducing emissions in dairy farming. The research suggested expanding the use of these effective practices and increasing farmer awareness.

Garcia (2021) explored the relationship between livestock emission reduction policies and sustainable grazing practices. Researchers conducted a longitudinal analysis of grazing management practices and emissions data in selected regions. The study demonstrated that policies promoting rotational grazing and improved pasture management contributed to reduced emissions and enhanced soil health. The research highlighted the potential for policy-driven sustainable grazing as a key strategy for emissions reduction.

Australian Government (2019) assessed the long-term effectiveness of livestock emission reduction policies and their impact on national greenhouse gas emissions. Researchers analyzed emissions data over several decades and conducted scenario modeling to project future emissions under different policy scenarios. The study found that sustained policy efforts led to significant reductions in emissions from the livestock sector and contributed to Australia's climate targets. The research emphasized the importance of continuity in policy implementation and encouraged further research into innovative emission reduction strategies.

3.0 MATERIALS AND METHODS

The study adopted a desktop research methodology. Desk research refers to secondary data or that which can be collected without fieldwork. Desk research is basically involved in collecting data from existing resources hence it is often considered a low-cost technique as compared to field research, as the main cost is involved in executive's time, telephone charges and directories. Thus, the study relied on already published studies, reports and statistics. This secondary data was easily accessed through the online journals and library.

4.0 FINDINGS

The current study presented both a contextual and methodological gap. A contextual gap occurs when desired research findings provide a different perspective on the topic of discussion. For instance; Garcia (2021) explored the relationship between livestock emission reduction policies and sustainable grazing practices. Researchers conducted a longitudinal analysis of grazing management practices and emissions data in selected regions. The study demonstrated that policies promoting rotational grazing and improved pasture management contributed to reduced emissions and enhanced soil health. The research highlighted the potential for policy-driven sustainable grazing as a key strategy for emissions reduction. On the other hand, our current study focused on livestock emission reduction policies and their impact on greenhouse gas emissions in Peru. Secondly, the study presented a methodological gap whereby, in their study on the relationship between livestock emission reduction policies and sustainable grazing practices; Garcia (2021) longitudinal analysis of grazing management practices and emissions data in selected regions. Our current study on livestock emission reduction policies and their impact on greenhouse gas emissions in Peru adopted a desk study research method.

5.0 CONCLUSION AND RECOMMENDATIONS

Conclusion

These studies collectively conclude that livestock emission reduction policies can have a substantial impact on reducing greenhouse gas emissions. However, the outcomes are influenced by factors such as policy design, implementation, and the specific context of each region. In some cases, stricter policies resulted in significant reductions in methane emissions from livestock, while in others, the policies led to unintended consequences, such as changes in land use or deforestation. Overall, the studies emphasize the importance of carefully crafted policies that consider the local context and aim to balance emissions reduction with other sustainability goals.

Recommendations

Based on the findings of these studies, several recommendations emerge for policymakers, researchers, and stakeholders involved in addressing livestock-related greenhouse gas emissions. Firstly, policymakers should design and implement policies that are tailored to the specific challenges and opportunities within their regions, taking into account the diverse nature of livestock farming practices. Secondly, there is a need for continued research and monitoring to assess the long-term impacts of these policies and to identify innovative and context-specific emission reduction strategies. Additionally, stakeholders should prioritize knowledge sharing and capacity building to ensure that farmers and communities can effectively adopt sustainable practices encouraged by these policies. Lastly, policy continuity and stability are crucial for achieving sustained reductions in emissions, and governments should commit to their climate targets while adapting policies as needed to achieve optimal results.

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