



# Sustainable Livestock Practices

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**Abstract.** Livestock farming is a strategic industry and has very important potential for the further development of agribusiness. It plays an important role in providing protein food for most of the global population besides uplift the rural livelihoods and economies in many developing countries. As the populations and incomes grow, along with changes in food consumption patterns, the demand for livestock products is increase in demand rapidly. In agriculture aspect, livestock play significant role in the farmer's economy. However, livestock production is a major global source of greenhouse gas emissions, and high livestock densities in certain areas can also cause local environmental problems. Therefore, future improvements in the global livestock sector can also be viewed as a potential opportunity to provide a significant portion of the needed mitigation of global warming and other environmental problems. Meanwhile, sustainable livestock farming is the important in protecting the environment besides improving the production. Knowledge of the sustainability performance of current animal husbandry systems can help formulate strategies for future systems. Herein, this paper aimed to gives an overview of practising livestock farming in a sustainable way which covers world livestock and Malaysia livestock sector, issues and problem encountered in livestock industry as well as sustainable livestock practices and strategies.

**Keywords:** agribusiness · livestock farming · sustainable · global warming

## 1 Introduction

Globally, agriculture sector is crucial for global economy, and More people than any other industry depend on it for their livelihood. To increase rural incomes, sustain the growing number of people depending on the sector, and supply the food and raw material demands of the urban populations, which are expanding at a faster rate, there is a need for increased agricultural productivity and production. A rise in agricultural productivity helps the industrial sector expand by bringing in capital, inexpensive labor, foreign exchange, and markets for manufactured goods.

Livestock farming is a strategic industry and has very important potential for the further development of agribusiness. It plays an important role in providing protein food for most of the global population besides uplift the rural livelihoods and economies in many developing countries. About 20.5 million people depend upon livestock for their livelihood [1] and poultry is raised by approximately 80 percent of rural households in

developing countries [2]. For example, India is the world's highest livestock owner at about 535.78 million [1], as well as the country with the highest number of cattle and buffalo in the world, followed by Brazil and China. In Southeast Asia, livestock sub-sector is one of the most important and strategic sub-sectors in Indonesia. The role of livestock farming in Indonesia particularly in the process of meeting the needs of food sources of protein for the community [3].

As the populations and incomes grow, along with changes in food consumption patterns, the demand for livestock products is increase in demand rapidly. [4] mentioned that the growth in demand for milk and meat, driven primarily by urban consumers in developing countries, has accelerated in recent decades and is projected to double by 2050. To meet growing demand, world poultry meat production increased from 9 to 133 million tons between 1961 and 2020, and egg production from 15 to 93 million tons [2]. Meanwhile, the continued growth and transformation of the livestock sector offers significant opportunities for agricultural development, poverty eradication, food security and improved human nutrition. The sector can also empower rural women and youth, improve efficiency in the use of natural resources, and increase household resilience to climate shocks.

Generally, livestock provides protein food like milk, meat, and eggs for human consumption. Then, livestock also contributes to the production of wool, hair, hides and pelts. Leather is the most important product which has a very high export potential. Besides, the dung and other animal waste materials serve as very good farmyard manure and the value of it is worth several crores of cost. In addition to that, the livestock's waste materials also used as fuel such as biogas, dung cakes. Other than that, livestock also considered as capital and in cases of landless agricultural labourers many times, it is the only capital resource they possess. Plus, livestock are also used as biological control of brush, plants, and weeds. Some people also use the animals like cocks, rams, bulls and so on for competition and sports. Despite ban on these animal competitions the cock fights, ram fights and bull fights are quite common during festive seasons.

In agriculture aspect, livestock play significant role in the farmer's economy. The livestock serve the farmers in different ways. First, livestock is a source of subsidiary income for many families in poor countries especially the resource poor who maintain few heads of animals. Livestock products are high-value products, especially when compared with crops. Cows and buffaloes if in milk will provide regular income to the livestock farmers through sale of milk.

Second, Numerous functions of livestock assist human livelihoods. All developing countries' nationally representative data show that 68% of households depend on their livestock for a portion of their income [4]. It was also stated that in mixed-culture livestock systems, livestock provided an average of 33% of income, with larger incomes being linked to the production of milk and poultry. Jobs have been created along the entire livestock value chain, from wholesale to animal production, trading, and processing to retail, as a result of the rising demand for milk, meat, fish, and eggs. Then, farmers will depend on livestock for draft. Landless and less land people usually depend upon livestock for utilizing their labour during lean agricultural season. The farmers especially the marginal and small depend upon bullocks for ploughing, carting and transport of both

inputs and outputs. Then, in rural areas dung is used for several purposes which include fuel (dung cakes), fertilizer (farmyard manure).

## 2 Results and Discussion

### 2.1 World Livestock

According to [2], livestock account for almost 40 percent of total agricultural production in developed countries and 20 percent in developing countries, supporting the livelihood of at least 1.3 billion people worldwide. Thirty-four percent of the world's dietary protein intake comes from livestock. Livestock consume about 6 million tonnes of dry feed matter annually, about half of which is grass. 86 percent of the world's livestock feed intake consists of resources that are inedible to humans. Grains account for about 13 percent of intake and about a third of global grain production [2]. According to [2], The United States of America is the world's largest poultry meat producer with 17 percent of global production, followed by China and Brazil.

In 2020, poultry meat represented almost 40 percent of global meat production. As reported by [5], global beef production for 2022 is virtually unchanged from April at 58.7 million tonnes. Global beef exports for 2022 are expected to increase 1 percent to 11.9 million tonnes. Growth in Brazil, Canada and Mexico more than offset a decline in Australia. Brazil is expected to export more of its production due to strong demand from China, Egypt, and the United States.

The prediction for 2022 global pork production is 110.7 million tonnes, essentially unchanged from the April forecast due to China's upward adjustment offsetting declines in the EU and Brazil. China's production will rise by over 2% to 51.8 million tons, but it will still be below pre-African swine disease levels. As export prospects dwindle and prices rise, production in the EU and Brazil is lowered down 2 percent to 22.6 million tonnes and 4.3 million tonnes, respectively. Global pork exports for 2022 are estimated to be 10.6 million tons, a decrease of roughly 10 percent. Chinese imports, which decreased by 39 percent to almost 2.2 million tons on better domestic shipments, are the main cause of the decline.

Global chicken meat output is expected to be 101.0 million tonnes in 2022, essentially unchanged from the April prediction, as growth in Ukraine more than makes up for declines in Brazil and the EU. While the EU continues to suffer with higher feed prices and the effects of highly virulent avian influenza, inflation in Brazil is reducing domestic demand. Exports of chicken worldwide are projected to increase by 1% from April to 13.5 million tonnes in 2022 as improved prospects in China and the Ukraine more than balance decreased exports from the EU and the UK (Fig. 1).

### 2.2 Malaysia Livestock Sector

In Malaysia, the livestock farming has contributed to the gross value added of agriculture sector with 3.5% during the year of 2020 [6]. In the livestock sub-sector of Malaysia, the number of livestock has increased, except for buffalo, sheep, and pigs. Although livestock has increased, production has decreased except for poultry meat, chicken or

## Global Pork Trade Reduced as China Pork Imports Revised Lower

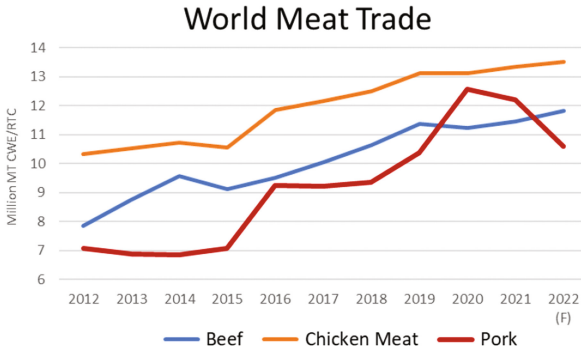


Fig. 1. World Meat Trade

duck eggs, and fresh milk. According to [7], the cattle population have increased from 657,407 in 2019 to 699,424 in 2020. Local production of beef decreased from 36,655 tonnes (RM 1,330.10 million) in 2019 to 34,828 tonnes (RM 1,260.77 million). For local fresh milk production, it has increased from 40.6 million Litres (RM 101.45 million) in 2019 to 41.8 million Litres (RM 104.44 million) in 2020.

Meanwhile, the number of buffalo breeders have decreased from 101,695 in 2019 to 64,250 in 2020. Local production of beef (buffalo) also decreased from 7,370 tonnes (RM 254.25 million) to 6,551 tonnes (RM 228.36 million). For goat, the number of goat breeders have increased from 7 312,571 in 2019 to 324,355 in 2020. However, the local production of mutton has decreased from 2,171 tonnes (RM 91.46 million) in 2019 to 1,823 tonnes (RM 77.48 million) in 2020. The sheep population in 2019 is 121,677 and increased to 124,674 in 2020. The local production of mutton (sheep) also slightly increased from 2,029 tonnes (RM 76.10 million) in 2019 to 2,094 tonnes (RM 78.73 million) in 2020. For swine, the swine population in 2019 is 1,888,460, decrease to 1,869,772 in 2020. This followed by the decreased in local production of pork, with 222,791 tonnes (RM 4,040.94 million) of production in 2019, decreased to 220,586 tonnes (RM 4,091.02 million) of production in 2020.

The chicken population in 2019 is 285,063,636, which has increased to 293,495,861 in 2020. The local production of chicken meat has increase from 1,589,081 tonnes (RM 10,645.01 million) in 2019 to 1,628,609 tonnes (RM 10,707.24 million) in 2020. For chicken eggs, the local production also has increased from 654 tonnes (RM 4,363.26 million) in 2019 to 774 tonnes (RM 4,873.68 million) in 2020. For duck, the population in 2019 is 9,376,456, which has increased to 9,511,085 in 2020. The local production of duck meat has increase from 66,212 tonnes (RM 1,039.52 million) in 2019 to 74,161 tonnes (RM 1,134.66 million) in 2020. However, for duck eggs, the local production also has slightly decreased from 22 tonnes (RM 299.23 million) in 2019 to 21 tonnes (RM 280.42 million) in 2020. The decline in commodities was also attributed to lack of demand from restaurants, eateries and hotels that were not operating or had limited operations due to the COVID-19 pandemic.

### 2.3 Issues and Problems in Livestock Industry

**Food Security.** The livestock industry is one of the fastest expanding agricultural sub-sectors in middle- and low-income nations as a result of rising incomes, altering diets, and population expansion. Through the whole livestock supply chain, this creates a significant potential for smallholders, agribusiness, and job creators. Without effective management, this increase, meanwhile, runs the danger of highlighting sustainability problems related to equality, environmental effects, and public health. The potential to steer the livestock industry toward more sustainable development and an improved contribution to human diets is provided by the changes that come along with expansion. It is possible to regulate productivity levels and methods to minimize dangers to animal and human health, as well as negative effects on the land, water, and environment.

**Climate Change.** Currently, the cattle industry contributes 14.5% of all human-induced greenhouse gas (GHG) emissions with its estimated 7.1 GT of CO<sub>2</sub>-equivalent emissions annually. Future GHG emissions must be constrained by improving the efficiency of animal supply networks. Livestock influence the climate through land use change, feed production, livestock production, manure, and processing and transport. Feed production and manure emit CO<sub>2</sub>, nitrous oxide (N<sub>2</sub>O) and methane (CH<sub>4</sub>), which consequently affects climate change. Animal production increases CH<sub>4</sub> emissions. Livestock do affect climate change, and climate change do influence livestock farming. Climate change is projected to significantly affect a variety of habitats and be a major cause of biodiversity loss [8]. Livestock production is affected in many ways by a changing climate. These include productivity changes in rangeland, pastures and crop yields as well as increased heat stress, which is known to have negative effects on production (meat and milk yield and quality), reproductive performance, and animal health and animal welfare [8]. As the environment is affected by climate change, the distribution of ruminants is also likely to be affected.

**Biodiversity Loss.** In developing countries, livestock farming is practiced in a range of diverse production methods. These can range from mixed livestock systems, which are typically found in areas suitable for both arable and livestock farming and where the majority of the rural population resides, to pastoral/grassland-based systems, which occupy the majority of the land area and have low human population densities. Intensive systems are typically found in peri-urban/urban areas [4]. Therefore, biodiversity is often reduced or destroyed by land use changes. One of the most striking examples of this is the conversion of forests into pasture and farmland [8]. Grazing can drive deforestation directly by requiring more land for grazing activities, or indirectly by using cleared land after other activities have ceased or clearing land to grow crops for animal feed [8]. Deforestation usually begins when roads are cut through forests, often for logging and mining. This in turn opens the area for commercial and subsistence farmers to plant crops. In particular, the cultivation of higher-quality soybeans and oil palms has driven deforestation. According to [9], soybean seeds provide high-protein fodder; 80 percent of Amazon soy is destined for animal feed. In addition, livestock farming depletes soil nutrients and pollutes the environment, as runoff from agricultural waste causes algal blooms that deplete oxygen in the water, kill vital bacteria and destroy healthy ecosystems.

## 2.4 Sustainable Livestock Practices

Livestock production is a major global source of greenhouse gas emissions, and high livestock densities in certain areas can also cause local environmental problems such as harmful ammonia emissions and regional nutrient imbalances. Nevertheless, future improvements in the global livestock sector can also be viewed as a potential opportunity to provide a significant portion of the needed mitigation of global warming and other environmental problems [10].

According to Sustainable Agriculture Network (SAN), practices that increase productivity and input use by implementing a multi-level system for feed resources and an associated management plan, minimize potential adverse effects on natural resources by prohibiting the destruction of natural ecosystems, optimize water and land use, and treat residual water, reduce GHG emissions, and enhance the systems' capacity as carbon sinks are all necessary for livestock to be sustainable. In addition, it also includes ensure animal welfare, meaning that animals are healthy, comfortable, well-fed, safe, can behave naturally, and are not subject to pain, fear and stress, minimize food safety risks through sanitary protocols and animal health monitoring and implement mechanisms for the verification of the animal's origin and breeding process throughout the supply chain.

Firstly, feed animals less human food [11]. About 70% of the grain used by industrialized countries is fed to animals. Livestock consume an estimated one-third or more of the world's grain, with 40% of this feed going to ruminants, mostly cattle [12]. This could be avoidable by feeding ruminants with hay, silage and high-fibre crop residues that are unsuitable for human consumption. Ruminants have a series of forestomach leading to the true stomach. In the forestomach, the largest of which is the rumen, microbes break down fibrous plant material into usable calories and provide high-quality microbial protein. Therefore, this could avoid big plantation of pasture for livestock grazing which lead to deforestation and land degradation.

Then, keep animals' health [11]. Mismanagement and poor welfare make animals particularly vulnerable to parasites and diseases. Many young animals die from disease before they can lactate, reach slaughter weight, or reproduce. This lowers yields, increases environmental impact and reduces farmers' ability to select the best breeding stock [11]. Improving animal health is an option to maintain high production efficiency of livestock and in this way keep emission intensity at a minimum level [10]. [13] determined that by eliminating the endemic disease trypanosomiasis could result in a reduction in emissions intensity per unit of protein produced as milk yields increase and cow fertility rates increase.

Furthermore, utilising technology could promote the sustainable livestock practices. In improving the animal welfare besides reducing the impact of the livestock sector, The European Union has made a significant investment in developing a tool named Precision Livestock Farming (PLF) [14]. PLF technologies include methods of electronically measuring the critical components of the production system that indicate resource use efficiency, interpreting the information collected, and controlling processes to ensure optimal efficiency of both resource use and animal productivity [15]. [14] future explained the PLF will provide new opportunities to increase the efficiency and sustainability of agriculture and animal production, improve animal health and welfare,

and support traceability throughout the supply chain, providing consumers with some assurance of food safety. The PLF aim to be fully automated, continuous management systems. Farmers will be provided with information from the system and this technology, for sure, making it possible to improve animal welfare, health, efficiency, and the environmental impact.

## 2.5 Sustainable Practices Strategies

**Good Animal Health = Lower Emissions.** Animal health is obviously crucial to maintain because healthy animals produce more and live better. They greatly increase the efficiency and profitability of the farming process. However, there is a factor that may not be as evident: good animal husbandry practices also have a negative influence on the environment. [16] even suggested that These livestock emissions could be reduced by 30% by implementing current health and husbandry best practices. Poor animal health, a lack of welfare, and livestock mismanagement make animals more susceptible to disease and might even die before reaching lactation, breeding age, or slaughter age. Animal health monitoring reduces the number of inactive animals that emit greenhouse gases (GHG). A study in Scotland discovered that better treatment of major illnesses in cows and sheep could result in significant savings. Ruminants account for roughly half of GHG emissions [17]. In beef cattle, for example, the disease Neosporosis affects birth rate, increasing GHG emissions. Study by [17] revealed that better disease management can indeed result in a 4.5% reduction in emissions, which is significant for one of Scotland's largest GHG emitters.

**Altering the Nutrition Mix.** In the quest to minimize livestock emissions, nutrition is crucial. On the farm, healthy animals have stronger natural immune systems because of the superior overall nutrition they receive. As a result, producers can produce enough food to satisfy local demand with fewer animals, reducing greenhouse gas emissions. Researchers have discovered that altering animal diet can reduce the levels of methane and nitrogen gas produced, both of which contribute to global warming. For example, in the study of [18] evaluated the effect of various lipids on the generation of methane in cattle feed. Angus heifers' diets included tallow, sunflower oil, and entire sunflower seeds. According to the findings, each animal released about 14% less methane when fed diets that included tallow or sunflower oil, and 33% less methane when fed diets that included sunflower seeds [18]. Offering an efficient method for some farms to reduce emissions. Adding food byproducts, such as sugar beet molasses, to animal feed has also been shown to help reduce emissions. This is due to its reliance on less energy-intensive grain crops.

**New Products to Target Methane Reduction.** Innovations in dietary supplements and vaccines are helping to reduce emissions by targeting the production of methane during the digestive process. Methane is produced in ruminants during digestion by fermentation in one of the four stomach chambers known as the rumen [11]. Dietary supplements that lower methane production have been developed. They function by inhibiting an enzyme that causes gut microorganisms to produce methane. 3-NOP, one such supplement, has been shown to decrease methane emissions in dairy cows by up to

30% [19]. Scientists in New Zealand have been developing a vaccination that functions similarly [20]. The methanogens, or gut bacteria that create methane, are the target of the vaccination. The vaccine stimulates the immune systems of the animals, rendering the methanogens insensitive. They simply pass through the stomach. A combination of industry innovation, good animal health, and animal welfare will result in more efficient farming practices and, as a result, more sustainable livestock farming.

## **2.6 A Comparison of Conventional and Organic Livestock Production System in Term of Sustainability**

Animal husbandry systems must raise production levels while lowering environmental impact, be economically viable, and uphold social responsibility in order to sustainably contribute to the food security of a larger and wealthier global population. Strategies for future systems can be formulated with the help of knowledge of the sustainability performance of current animal husbandry systems.

In principle, organic animals must have access to pastures. Most of these animals will never live to experience fresh air and sunlight, which are basic needs of all living things. Organically kept animals also have more space available. Organic farmers usually choose more robust, locally adapted animal breeds. They are allowed to be outside more often and graze on fresh pasture grass and get more space. This alone prevents many diseases in organic farm animals. Meanwhile, conventionally kept animals rarely if ever have access to the outside. Conventional farming and breeding have produced high-yielding animals. At the same time, these animals are much more susceptible to diseases than they used to be. As a result, they need medical treatments more often. In addition, diseases can spread more easily on conventional farms due to the high number and density of animal husbandry.

In terms of economy, organic livestock production generates higher income per animal or full-time employee as compared to conventional livestock production. According to the review from [21], organic pricing for beef cattle, broilers, and laying hens were up to 25%, 107%, and 139% more than conventional prices, respectively. Organic farm revenue increased by 170%, 124%, and 156%, respectively, for beef cattle per capita, broilers per farm, and laying hens per full-time equivalent.

In terms of productivity, the production of livestock in organic system is lower as compared to conventional production of livestock. In the review of [21], production of pig is lower in organic system, consistent with the dairy cattle studies. They further discussed the production of pig still lower even the feed intake and feed conversion ratio of organic fattening pigs were similar or higher than of conventional fattening pigs.

In terms of environment, organic livestock production, conventional system will have lower acidification and eutrophication potential per unit product while impacts per unit product were higher in organic systems across all species, except for the AP of beef cattle, which was lower [21]. Lower productivity levels in organic systems were the main cause. Land use per unit product was consistently higher in organic systems for all species. Energy use was lower in organic system for beef cattle but higher for laying hens, broilers, and pigs. Differences in energy use between livestock species associated



with differences in diet and the ability of ruminants to utilize grass and other roughage products that can be produced with little energy.

In terms of animal welfare, such as animal behaviour and emotional well-being, [21] reported that traditional farms had a higher frequency of leg issues. This was mostly connected to the adoption of more robust or slower-growing genotypes in broilers, and higher activity in sows through outdoor exercise. Additionally, higher stress resistance in organic pigs and broilers can be attributed to many genetic factors, more area per animal, and outdoor activity. Furthermore, non-caged organic laying hens (conventional or organic) and pigs had more worm infections, which the studies attributed to increased exposure to manure and free-range systems. In terms of public health, [22] concluded that organic meat is more commonly contaminated with food - borne pathogens than standard meat. Nonetheless, some studies concluded that bacterial contamination in retail chicken and pig meat was unconnected to farming practices [23].

### 3 Conclusions

In conclusion, livestock production play important roles not only in boosting up the agriculture economy, improved rural livelihood, also provide food, primary materials for manufacture and so on. Globally, recent increases in livestock productivity have been primarily driven by animal science and technology, and scientific and technological developments in breeding, nutrition and animal health will continue to help increase potential production and further efficiencies and genetic gains. However, it is needed the understand the impact of livestock farming to environment and human well-being. Sustainable livestock farming is the important in protecting the environment besides improving the production. Sustainable livestock production should come into consideration from many aspects including sustainable animal husbandry systems, animal health and welfare, integration of livestock farming into the landscape and the community, contributions in the areas of energy, climate and the environment, business opportunities and a viable market and responsible consumption.

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