

The Shift of Livestock Industry and Its Impact on People's Social-economic Status

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ABSTRACT

A literature review has been conducted to describe the anticipated effects of social-economic status transformation among farmers due to livestock biotechnology and industry shifting. In particular, it focused more on Indonesia, where lay the Indo-pacific region as a biogeographic area connecting tropical waters of the Indian and western part of the Pacific Ocean. This area is critical for the dynamic change of the global supply chain network and trade corridors. While a pandemic breaking of covid-19 affects the dynamic transformation, several indications could be identified. Firstly, smallholder livestock farming in developing countries such as Indonesia will gain a moment of accelerated growth by using a collective action model. This approach covers both supply and demand sides, whether using cooperative or contract farming institutions. Its targets are to achieve more productivity, efficiency, and decrease processing loss along with the supply chain. The effort to link smallholder livestock farming to the supply chain – based on the state's legal acknowledgment – leads to greater sustainability. Within a more complex supply chain, there will be a larger role of smallholder livestock farming in the long-term period. An institutional and collaborative pathway should be followed to anticipate the requirement of an emerging food system. Its characters consisted of high demand for food safety, traceability, and compliance, which often work against smallholder capacities. Several factors affecting the smallholder livestock farmers' social-economic status – due to market failures – really require the state policies intervention using its basic regulation. Using extension services or technical assistance, good infrastructures, good and reliable sources of information, certification and standard operating procedures will benefit for coordination to market access. These efforts will hold information asymmetry, high transaction cost, lack of coordination, and regulatory failures.

Keywords: Livestock, industry, biotechnology, small and medium sized enterprise

1. INTRODUCTION

Although the UN's Agriculture and Food Organization (FAO) predicts global demand for agricultural commodities and food will slow by 2030, compared (2.2% growth) to the previous decade-spanning 2010-2020 – as stated by [1] – it will continue to increase by 1.2 % in the next decade (2020-2030). Technically, the total number of requirements will not decrease, but its growth rate will slow down. Then, the effort to search for a new approach using biotechnology and alternative options is always put forwards to provide future population demand. Therefore, an efficient and productive effort of decreasing material loss along with the supply chain corridor should be taken into account in managing livestock production and post-harvest processing.

In detail, FAO report stated that global demand for dairy, which increased by 2% between 2010 and 2020, is expected to increase by 1.8% in the 2020-2030 period with a very limited slowdown. The report also predicts an increase of 1.2% in grain production for nutritional use by 2030 and a 1.2% increase in demand for meat, milk, eggs, and fish due to the expected demand spike in underdeveloped and middle-income countries.

With the forecast that the world population, which reached 7.8 billion between 2018 and 2020, will reach 8.5 billion in 2030, the projection of a 1.3% increase in global food demand stands out. Based on the real values of the 2018-2020 period are compared with the projections for the 2030 period, the use of meat will increase from 350 million tons to 400 million tons. [2] FAO's research also shows that,

on a global scale, 14% of agricultural products and food spoils before it reach the table. Then that 17% of the food that reaches the consumer is wasted due to misuse, wrong or inadequate storage methods.

Progress of achieving the target to fulfil food supply in particular for livestock products to provide population demand is being affected by challenging covid-19 pandemic condition. Vitamin D (stand for development) should be prioritized due to shrinking economic growth and open unemployment; on the other hand, consumers' price inflation. Adjustment and correct policies execution should be taken to handle the economic damage caused by the global pandemic situation. In particular effect of pandemic covid-19 has surpassed the level that cannot be covered by the resources of companies themselves, especially for small and medium-sized enterprises (SMEs) worldwide. Although in developing countries, such as Indonesia – as important data in a newly published report of the World Bank points out – the share of developing countries in global exports increased from 16% to 30% between 1990 and 2017. Moreover, poverty level decreased from 36% to 9% in the same period.

SMEs focussing livestock business in developing countries is one of complexity, where livestock interact with various natural resources, social issues, and development objective. Again – as stated [3] – the SMEs is also one of the superimposed patterns, where farming techniques and management system of different standard coexist. In addition, SMEs' local endogenous development processes are increasingly influenced by the intrusion of international trade. While there is local consideration in terms of policy formulation, shifting in livestock technology and industry enforcement to recognize the need to combine measures to balance policy mixes.

This paper shows a shift in livestock industry development and its impact on people's social-economic status, particularly those of running SMEs on a livestock basis. It consisted of two scopes; (1) biotechnology and shifting of livestock industry and (2) technological (positive and negative) effects for socio-economic and livestock SMEs status. Then it put forward four strategies to cope with the current problem where public policies formation plays an important role in lieu of market failure. (1) collective action to accelerate growth, (2) greater sustainability role for SMEs, (3) institutional collaboration, and (4) policy intervention for livestock SMEs empowerment.

2. BIOTECHNOLOGY AND SHIFTING OF LIVESTOCK INDUSTRY

Biotechnology is one of the avenues for improved production in the “livestock revolution”. As shown in Table 1, biotechnology developments applied to livestock health, nutrition, breeding, and reproduction are improving at a reasonable pace in developing countries as well as in Indonesia. Simple bio-techniques such as artificial insemination have been well implemented in many regions. But advanced

technologies, including transgenic plant vaccines, marker-assisted selection, solid-state fermentation for the production of fibrolytic enzymes, transgenic foddors, embryo transfer, and animal cloning, are confined largely to research organizations.

As an Indonesian experience, some developing countries such as Taiwan, China, and Brazil have considered the commercialization of biotechnology in the livestock sector. Several aspects could improve, such as organized livestock production systems, proper record management, and capacity building. Then it also could be taken into account the objective-oriented research to improve farmer's income, collaborations with the various stakeholders, knowledge of the sociology of a local area to do research. Finally, effort to search for new methods to educate farmers and policymakers. Those activities are required to improve the creation and implementation of biotechnology advances in the livestock sector.

While the biotechnological developments are promising, to improve further, Indonesia and developing countries need to make collaborative ventures and form multidisciplinary teams within national and regional frameworks to implement biotechnology programs successfully. Collaboration would extend resources and lessen the cost. Taking a lesson from developed countries, there is a requirement to shift from traditional high quantity of production to high quality and efficiency of production. Then it is also taken into consideration the health traits of livestock, which should establish the livestock production systems against adverse environmental conditions. In particular, for those dominantly SMEs characteristic of livestock and considered as a back-yard farming system.

3. BIOTECHNOLOGICAL EFFECTS FOR SOCIO-ECONOMIC AND STATUS OF LIVESTOCK SMEs

These dominantly SMEs characteristic of livestock face three domains contrasting to industrial development. Whether it's a positive or negative impact on socio-economic and status of livestock SMEs. Firstly, driven by growth in incomes, population and urbanization, the livestock sector is rapidly shifting. The potential for increased demand for livestock products is substantial. It implies challenges in efficient use of natural resources, managing animal – and human – health risks, alleviating poverty, and ensuring food security.

Then, the growing demand for livestock products and technological changes along the food chain have spurred major changes in livestock production systems. Small-scale mixed production systems face increased competition from large-scale specialized production units based on purchased inputs. These trends present major competitive challenges for smallholders and have

implications for the ability of the sector to promote poverty reduction.

Finally, the shift from small-scale mixed production systems, based on locally available resources, to large-scale industrial systems has also changed the location of

livestock production units. As the constraint of locally available natural resources is removed, the spatial distribution of livestock production facilities is becoming more clustered to exploit linkages along the supply chain. This has increased the efficiency of production but has implications for natural-resource use.

Table 1. Summary of biotechnology developments in developing countries

No	Biotechnology area	Implementation in developing countries
1	Livestock health	<p>It is a very important area in developing countries because of high disease challenges.</p> <ul style="list-style-type: none"> • Focus is mainly on the production of vaccines against 'orphan' diseases of the developing world such as Theileriosis and Babesiosis, and also on early diagnosis of disease. • Live attenuated vaccines, subunit recombinant vaccines, combined vaccines, and naked DNA vaccines have been used to control livestock diseases. • Development of stable heat vaccines not requiring refrigeration.
2	Animal breeding	<p>One issue which is of importance in developing countries is an improvement of animal productivity through crossbreeding while at the same time preserving genotypes of native animals that are adapted to the conditions in developing countries.</p> <ul style="list-style-type: none"> • There are efforts to characterize local breeds. • Problems associated with inadequate infrastructure hinder the utilization of Marker Assisted Selection and Single Nucleotide Polymorphism technologies in developing countries. • Use of genomics to predict best-crossbred performance.
3	Animal nutrition	<p>High fiber and lignocelluloses in ruminant feeds lead to poor nutrient availability and inefficient feed utilization. Grain-based feeds for monogastric animals are also deficient in some key nutrients.</p> <ul style="list-style-type: none"> • Conventional selection methods have improved the digestibility of certain fodder plants. • Research on lignin modification is ongoing at several research institutes, but the technology has largely not been adopted in the field. • There is extensive use of feed additives to correct nutrient deficiencies in animal feeds. • Research on manipulating rumen micro-organisms to increase feed efficiency and reduce methane gas production is still limited to developed countries.
4	Livestock reproduction	<p>A major limitation of livestock production systems in developing countries is low fertility and less genetic potential of animals.</p> <ul style="list-style-type: none"> • Artificial insemination is the most widely adopted reproduction technology. It has been used to upgrade the genetic potential and increase the productivity of animals. Technical as well as extension constraints limit the complete success of the technology in some areas. • In many developing countries, multiple ovulation and embryo transfer are still confined to research centers. There is potential to use the technology to combat disease. A few countries are importing embryos on a commercial basis. • Some developing countries have successfully cloned animals.

Source: [4]

The increasing concentration of production and growth in trade is leading to new challenges in the management of animal diseases.

Within a wider perspective, rapid growth and technological innovation (industry) have led to profound structural changes in the livestock sector. Those include: (1) a move from smallholder mixed farms towards large-scale specialized industrial production systems; (2) a shift in the geographic locus of demand and supply to the developing world; and (3) an increasing emphasis on global sourcing and marketing. These changes have implications for the ability of the livestock sector to expand production sustainably in ways that promote food security, poverty reduction, and public health. It also challenges the efforts to improve livelihoods, alleviate poverty and food insecurity, reduce pressures on natural resources and manage human and animal diseases.

How can we come up with efforts to anticipate, manage, and rehabilitate such positive and negative effects of shifting livestock industry stimulated by biotechnological advances? As shown by [5] there were five domains in the supply chain support process that require scrutinization closely; extension services; infrastructure development; information services; certification, grade and standards; and coordination mechanism.

In detail, livestock SMEs face market failure that needs transformation of institutional roles and policy. In extension services, livestock SMEs confront various access to public or private extension; limited public knowledge of new techniques and understanding of services.

In infrastructure development, livestock SMEs challenge five problems; high transportation costs, low access to smallholder areas, poor infrastructure, erratic information flows, crowding out by the public sector.

Information services face market failure constraints in terms of livestock SMEs' imperfect information by smallholders, particularly on the need for buyers and customers in a high value of agricultural products.

Legally aspect of such livestock products requires certification, grades, and standards. Within market failures condition affecting smallholders, livestock SMEs need a capacity-building process to meet limited public or private standards; divergence between public and private standards; and low capacity to enforce public standards.

Finally, in terms of coordination mechanism – which is easy to say and difficult to take action – livestock SMEs have limited enforcement of working contracts and divergence in market power between chain actors.

Based on Indonesia's basic regulation stipulating three different institutions to provide welfare services to all people, four provisions should be put forward;

(a) Collective action basis to accelerate growth.

This approach covers both supply and demand sides, whether using cooperative or contract farming institutions. Its targets are to achieve more productivity, efficiency, and decrease processing loss along with the supply chain. The future of this livestock SMEs will be largely driven over the medium to long run by the issue of whether this collective action approach can sufficiently reduce the transaction cost. Thus, livestock SMEs can continue to compete with larger farms.

(b) Greater sustainability for SMEs. The effort to link smallholder livestock farming to the supply chain – based on the Indonesian state's legal acknowledgement – lead to greater sustainability. A more complex, demand-responsive supply chain may play a larger role in long-term sustainability. It is also important to look at potential ways to link livestock SMEs to a high-value supply chain. In contrast, the requirement of an emerging food system often works against SMEs cost-controlled capacity due to the high standards demand for food safety, traceability, and compliance.

(c) Institutional collaboration. The institutional and collaborative pathways should be followed to anticipate the requirement of emerging food systems. Its characters consisted of high demand for food safety, traceability, and compliance, which often work against smallholder capacities. On the one hand, livestock SMEs contrast a larger operation that takes benefit from economies of scale due to the 'inefficient' image of smallholders. Consequently, SMEs lose opportunities for growth and poverty alleviation unless there are some mechanisms in establishing institutional collaboration. On the other hand, collaboration facilitates SMEs to link them – in some ways – to the larger chain and ensure they meet all the changing demands of the market.

(d) Policy intervention for Livestock SMEs empowerment.

Several factors affecting the smallholder livestock farmers' social-economic status – due to market failures – really require the Indonesian state policies intervention using its basic regulation. In contrast to or instead of anticipating collaboration negative impact of livestock SMEs to larger supply chain, then policies should endorse solving the problems of information asymmetry, high transaction cost, lack of coordination, and regulatory failure. In detail, livestock SMEs need support through extension services, technical and capacity-building assistance, good infrastructure, good and reliable sources of information, certification, grades, and standards. In particular, there is a need for a good mechanism for coordination of taking supplies to markets.

REFERENCES

- [1] Alkin, Kerem, 2021. Whoever plans well will win in the global food industry. Daily Sabah Colum, July 10, 2021.

- [2] FAO. 2017. The future of food and agriculture – Trends and challenges. Rome.
- [3] Gerber, Pierre; H. Mooney; J. Dijkman; S. Tarawali and C. de Haan. Livestock in changing landscape; experiences and regional perspective. Volume 2. Island Press. Washington.
- [4] Onteru, SK; Agatha Ampaire and Max Rothschild (2010) Biotechnology developments in the livestock sector in developing countries, *Biotechnology and Genetic Engineering Reviews*, 27:1, 217-228, DOI: 10.1080/02648725.2010.10648151
- [5] Narrod, Clare; Marites Tiongco and Christopher Delgado, 2010. Socioeconomic implication of the livestock industrialization process. In Steinfeld et.al. 2010. Livestock in changing landscape; drivers, consequences and responses. Volume 1. Island Press. Washington.